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Comparison Of Diabetes Education Across Age Group, Gender, And Diabetes Type

Katey Korhonen
Eastern Illinois University

COMPARISON OF DIABETES EDUCATION ACROSS AGE GROUP, GENDER, AND DIABETES TYPE

KORHONEN

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Comparison of Diabetes Education Across Age Group, Gender, and Diabetes Type

(TITLE)

BY

Katey Korhonen

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ABSTRACT

The purpose of this study was to compare the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and helping patients identify causes of sub-optimal control of blood glucose. Patient educational tools compared included: verbal information from a physician, consultations with a dietician, sessions with a diabetes educator, written materials such as pamphlets or brochures, Internet sources of information, use of finger stick glucose monitoring, and use of the Continuous Glucose Monitoring System.

One hundred individuals with diabetes (63 females and 37 males) responded to an online survey that was hosted at www.myq3.com. Their ages ranged from 14 to 78 years (mean age = 32.5 years, SD = 14.4). There were 60 respondents with type 1 diabetes, 28 respondents with type 2 diabetes, and 10 women reported having gestational diabetes. The type of diabetes education that overall had the most impact on the participants was a consultation with a diabetes educator (selected by 35% of respondents), although type 2 diabetics felt that a consultation with a dietician had the most educational impact The older respondents, ages 40-78 years, indicated that verbal information from a physician and written materials such as pamphlet or brochures also had a positive impact.

The diabetes education received by the survey respondents seemed to be effective as 88 out of 100 participants felt they had more control over blood sugar levels after receiving education. The lifestyle changes reported by participants included diet, weight, exercise, and sleep. Seventy- four of the one hundred participants changed their diets. The most frequent change was having less sugar and the least frequent was consuming less alcohol. Forty-five percent of the participants had weight loss, 35% had no changes

and 19% had weight gain. The overall number of participants who exercised on a regular basis after receiving education was 63 of the 99 participants who answered the question. The most common type of exercise performed was aerobic exercise and the least common exercise performed was sports. Sixty-two of ninety-nine participants became aware of glucose changes during sleep. Overall 83% participants have made positive changes in their everyday lifestyle after receiving education. In conclusion, education was extremely important and beneficial for motivating and helping diabetic patients make lifestyle changes and identify causes of suboptimal control of blood glucose.

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CHAPTER I

INTRODUCTION

Diabetes is a chronic health condition in which the body is unable to produce insulin or properly utilize insulin. The two most common types of diabetes are called type 1 and type 2. Type 1 diabetes was previously known as a childhood disease. It is an autoimmune disorder in which the body's own immune system attacks the beta cells in a group of endocrine cells in the pancreas, destroying them or damaging them to reduce and eventually eliminate insulin production. There are several symptoms that include hunger, thirst, excessive urination, dehydration, and weight loss. Type 2 diabetes was previously known as adult-onset diabetes or non-insulin dependent diabetes. It results from a combination of defective insulin secretion and insulin resistance or reduced insulin sensitivity (defective responsiveness of tissues to insulin), which almost certainly involves the insulin receptors in cell membranes. The next form of diabetes is gestational diabetes that develops only during pregnancy and usually disappears upon delivery, but increases the risk that the mother will develop diabetes later. It is managed with meal planning, activity, and, in some cases, insulin. (American Diabetes Association, 2007).

Diabetes is treated through medication (insulin injections or oral medication), dietary modification, and physical activity. The patient's physician is usually the first source of information for the newly-diagnosed diabetic individual. Along with prescribing medication, he or she may offer suggestions about lifestyle changes that will increase the patient's overall wellness. In addition, the physician may recommend that the patient attend sessions with a diabetes educator and/or a dietician.

Sessions with a diabetic educator will further inform the patients about their condition and ways to cope during everyday life. Newly-diagnosed diabetics enroll in a class which allows them to learn about specific lifestyle changes that need to be made. The sessions may include information, for example, about physical activity and about dietary modifications. Individual or group sessions with a dietician can also be beneficial in educating diabetic patients about appropriate dietary modifications.

Pamphlets and brochures are another way to educate diabetics about their conditions. Written materials may be a good reference for patients when there are questions about certain aspects of their condition. The pamphlets and brochures can also give information about certain statistics about diabetes in general.

Increasingly, individuals diagnosed with diabetes are using the Internet as a source of information about treatment and lifestyle modification. Websites of organizations such as the American Diabetes Association, the Mayo Clinic, and WebMD provide a wealth of practical suggestions to patients with diabetes.

While all of these methods of education can be valuable to an individual with diabetes, appropriate control of blood glucose levels is dependent on a patient's knowledge of how medications, diet, and physical activity are affecting blood glucose. Traditionally finger-prick blood sampling has been used to monitor glucose levels. This method has several disadvantages such as less accuracy and reliability, with reading the monitor at times such as night time, during food intake, physical activity. The Continuous Glucose Monitoring System is a device that was presented by Medtronic MiniMed to the American Diabetes Association in June 2003. It is a device that a diabetic patient has inserted by the doctor under the abdomen. A sensor measures the tissue glucose level

every ten seconds and sends the information to a monitor (which is a pager-sized device). This system records an average glucose measurement every five minutes for three days. In a twenty-four hour span there are approximately 228 glucose measurements. Once the patient has completed the three days, he/she consult with a physician who downloads data from the monitor to a computer where easy-to-understand graphs and charts can be printed or displayed. The physician then explains when the patient's blood sugar was at an ultimate high, low or normal level. This information enables the patient to become educated and aware of what they were doing at the time of each recording and the reaction of blood glucose level. As the patient becomes educated, there are several suggestions a physician might make to the patient, such as changing diet or performing exercise.

Purpose of the Study

The purpose of this study is to compare the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and helping patients identify causes of suboptimal control of blood glucose. Patient educational tools to be compared include verbal information from a physician, sessions with a diabetes educator, consultations with a dietician, written materials such as pamphlets or brochures, Internet sources of information, use of finger stick glucose monitoring, and use of the Continuous Glucose Monitoring System.

Hypothesis

Participants who have used the Continuous Glucose Monitoring System as an education tool will be more educated about their own blood glucose levels than participants who received education using the finger stick glucose monitoring,

consultations with a dietician, sessions with a diabetes educator, verbal information from a physician, written materials such as pamphlets or brochures, and Internet sources of information.

Scope of the Study

The study involved administrators and teachers in the Chicago District 218 (Richards High School, Shepard High School, and Eisenhower High School), District 118 (Palos South), and Bloomington Unit Five District (Normal Community West High School). It also included patients contacted by a Medtronic MiniMed representative who worked with patients in the southwest suburban area of Chicago.

Limitations

Participants in this study were located in the Midwest, primarily in Illinois. Results might have been altered if there had been a national sample since there are possibly regional differences in diabetes patient education. The sample may have been skewed by using a Medtronic representativeto solicit subjetcs for the survey.. Also the small sample size of 100 participants may be a limitation.

Assumptions

1. The researcher e-mailed the cover letter to the principals and then the principals forwarded it to all faculty and staff.
2. Each question was answered honestly.
3. The survey would be filled out completely.
4. All participants were in fact diagnosed with diabetes.
5. All participants understand the terminology used in the survey.

Definitions of Terms

A1C: a test that measures a person's average blood glucose levels over the past 2 to 3 months. Hemoglobin is the part of a red blood cell that carries oxygen to the cells and sometimes joins with the glucose in the bloodstream. Also called hemoglobin A1C or glycosylated hemoglobin, the test shows the amount of glucose that sticks to the red blood cell, which is proportional to the amount of glucose in the blood (American Diabetes Association, 2007).

Diabetes Educator: a health care professional who teaches people who have diabetes how to manage their diabetes. Some diabetes educators are certified diabetes educators (CDEs). Diabetes educators are found in hospitals, physician offices, managed care organizations, home health care and other settings (American Diabetes Association, 2007).

Diabetes Self-Management Education: is a critical element of care of all people with diabetes and is necessary in order to improve patient outcomes. The National Standard for Diabetes Self-Management Education are designed to define diabetes self-management education and to assist diabetes educator in a variety of settings to provide evidence-based education (Funnell, 2008).

Gestational Diabetes: occurs in pregnant women who have never had diabetes before but who have high blood sugar (glucose) levels during pregnancy. (American Diabetes Association, 2007).

Glycemic index: a ranking of carbohydrate-containing foods, based on the food's effect on blood glucose compared with a standard reference food (American Diabetes Association, 2007).

Hyperglycemia: the technical term for high blood glucose (160mg/dL or above). High blood glucose happens when the body has too little insulin or when the body can't use insulin properly (American Diabetes Association, 2007).

Hypoglycemia: (also called an insulin reaction) occurs when blood glucose levels are too low (less than 60 mg/dL). Hypoglycemia can be caused by a number of factors: too much insulin, not enough food, too much exercise, eating late, or eating too little carbohydrates. In short, hypoglycemia occurs when insulin and blood glucose are out of balance (American Diabetes Association, 2007).

Insulin: a hormone that helps the body use glucose for energy. The beta cells of the pancreas make insulin. When the body cannot make enough insulin, it is taken by injection or through use of an insulin pump (American Diabetes Association, 2007).

Insulin receptors: areas on the outer part of a cell that allow the cell to bind with insulin in the blood. When the cell and insulin bind, the cell can take glucose from the blood and use it for energy (American Diabetes Association, 2007).

Insulin resistance: the body's inability to respond to and use the insulin it produces. Insulin resistance may be linked to obesity, hypertension, and high levels of fat in the blood (American Diabetes Association, 2007).

mg/dL: milligrams per deciliter, a unit of measure that shows the concentration of a substance in a specific amount of fluid (American Diabetes Association, 2007).

mmol/L: millimoles per liter, a unit of measure that shows the concentration of a substance in a specific amount of fluid (American Diabetes Association, 2007).

Type 1 Diabetes: results from the body's failure to produce insulin, the hormone that "unlocks" the cells of the body, allowing glucose to enter and fuel them. It is estimated that 5-10% of Americans who are diagnosed with diabetes have type 1 diabetes (American Diabetes Association, 2007).

Type 2 Diabetes: results from insulin resistance (a condition in which the body fails to properly use insulin), combined with relative insulin deficiency. Most Americans who are diagnosed with diabetes have type 2 diabetes (American Diabetes Association, 2007).

CHAPTER II

LITERATURE REVIEW

This chapter reviews research comparing the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and helping patients identify causes of suboptimal control of blood glucose. It also discusses the National Standards for diabetes self-management education. This literature review is organized into four major areas: national standards for diabetes self-management education, content of self-management education, educational approaches, and cultural barriers.

Diabetes is a chronic disease that affects more than 20 million Americans. The American Diabetes Association (ADA) in 2002 estimated the cost of treating diagnosed diabetes in the United States to be $132 billion. (American Diabetes Association, 2008b). The ADA position statement in 2008 said:

> to achieve optimal glycemic control, thus achieving long-term reduction in health care costs, individuals with diabetes must have access to the integral components of diabetes care, such as health care visits, diabetes supplies, self-management education, and diabetes medications. As such, insurers must reimburse for diabetes-related medical treatment as well as for self-management education programs that have met accepted standards, such as the American Diabetes Association's National Standards for Diabetes Self-Management Education. Furthermore, third-party payers must also reimburse for medications and supplies related to the daily care of diabetes. These same standards should also apply to

> organizations that purchase health care benefits for their member or employees, as well as managed care organizations that provide services to participant.
>
> (American Diabetes Association, 2008b, p. 2)

As the position statement concludes, if all of the following above would be implemented, then it would be easier for diabetic patients to seek the education that is needed.

National Standards for Diabetes Self-Management Education

People who are diagnosed with diabetes have several options of self-management education tools to use. The National Standards for Diabetes Self-Management Education were published in January 2008 and provide standards covering structure, process, and outcomes of diabetes education. Particularly pertinent is Standard 5 which addresses the qualifications of diabetes educators and the optimal make-up of a multidisciplinary team. Within the evolving health care environment not only are registered nurses, registered dietitians and pharmacists a part of the multidisciplinary team; it now should also include a physician, behaviorist, exercise physiologist, ophthalmologist, optometrist, and podiatrist, and most recently community workers and/or peers to provide information. Standard 6 defines the make-up of a written curriculum for diabetes self-management education. The curriculum content should include incorporating nutritional management into lifestyle; incorporating physical activity into lifestyle; using medication safely and for maximum effectiveness; monitoring blood glucose and using the results for decision making; preventing, detecting, and treating acute and chronic complications. It also should focus on the importance of individual's tailored needs and be adapted as necessary to age, type of diabetes (such as pre-diabetes, pregnancy), cultural influences, health literacy and other co-morbidities. Standard 7 emphasizes the importance of having

an individual assessment and education plan for each patient, while Standard 8 addresses the importance of a personalized follow-up plan for ongoing self-management support. Overall the primary responsibility for diabetes education belongs to the diabetes self-management educator, but patients benefit by receiving reinforcement of content and behavioral goals from their entire health care team (Funnell,et al. 2008).

Funnell et al. (2008) say "Diabetes self-management is the ongoing process of facilitating the knowledge, skills, and ability necessary for diabetes self-care. This process incorporates the needs, goals, and life experiences of the person with diabetes and is guided by evidence-based standards. The overall objectives are to support informed decision-making, self-care behaviors, problem solving and active collaboration with the health care team and to improve clinical outcomes, health status, and quality of life." (p. S97) These ten standards have become the basis of education for diabetes self management tools.

Content of Diabetes Self-Management Education

Blood Glucose Monitoring

A study was conducted by Sachedina and Pickup (2003) to determine the accuracy and reliability of two different measurements to control glycemic levels. The continuous glucose monitoring system was compared to the blood glucose self-monitor with type 1 diabetic patients. The participants were recruited type 1 diabetic patients with glycemic control problems. There were 18 participants who used the continuous glucose monitoring system for three days, while they also used blood glucose self monitoring. The Continuous Glucose Monitoring System was analyzed by Medtronic MiniMed Solution Software, and the blood glucose self monitor readings were superimposed on the

error grids of Clarke and Parkers. The researchers concluded the continuous glucose monitoring system has acceptable clinical accuracy compared to the blood glucose self monitor. Sachedina and Pickup (2003) found 95% of paired non-calibration samples were in the clinically acceptable zones of Clarke error grid, and 97% in a consensus grid. The median bias was 0.1 mmol/1 and relative bias 15%.

A study by Stout, Racchini, Hilgers, and Nougjim (2006) points out that hypoglycemia is becoming an increasing problem today. Many diabetics do not have a clear picture of what their glycemic profiles are hour to hour or even day to day. The purpose of this article was to determine the accuracy of different methods of measuring glucose levels. There were 22 diabetic patients who were used as subjects. Interstitial fluid samples and a finger capillary blood glucose reading were taken and compared. Stout et al. stated, "The methodology presented using a pressure modulation technique to create an elevation in blood flow holds promise for significantly mitigating one of the most significant components of accuracy error for continuous monitoring system." (p. 98) Stout et al. (2006) concluded that more work and testing remains to be done before the continuous monitoring system method achieves a commercial embodiment, but the promise of an accurate continuous monitoring system device is very close.

Another study by Djakoure-Platonoff et al. (2003) covered the ways to evaluate the accuracy of the continuous glucose monitoring system in inpatient and outpatient conditions. During the inpatient conditions, the Continuous Glucose Monitoring System was supervised by experienced nurses. During the outpatient conditions, the Continuous Glucose Monitoring system was cared for by the patient. The inpatient study consisted of 12 type 1 diabetic patients who had the sensor inserted by experienced nurses to monitor

glucose levels for three days. In addition, the patient performed eight capillary glucose tests each 24 hours, one every three hours. There were four values used for automatic calibration of the sensor, and four values for evaluation of accuracy vs. capillary glucose values. The outpatient study consisted of 41 type 1 diabetic patients. Twenty-one patients used the continuous glucose monitoring system for three days and 20 used the continuous glucose monitoring system for six days (there were two insertions: both first insertion and second for education were realized during a clinical visit in the hospital). The patients performed seven capillary glucose tests per 24 hours: four values for automatic calibration and three for evaluation of accuracy of the sensor. The data confirmed accuracy of the continuous glucose monitoring system in inpatient and outpatient conditions. The correlation coefficient was .92, .81, and .73 in the inpatient, six day out patient and three day outpatient studies respectively.

Clarke et al. (2005) completed another study to compare the accuracy of two different continuous glucose sensors during euglycemia and hypoglycemia by using the continuous glucose error grid analysis. There was a group of 16 patients who had the Freestyle Navigator and Mini Med Continuous Glucose Monitoring System. The Freestyle Navigator and Mini Med are both glucose monitoring systems, more specifically they both are applied to the abdomen of each subject at the same time. The Freestyle Navigator was calibrated at one, three and 24 hours after insertion and the Continuous Glucose Monitoring System was calibrated before operation and then four additional times six hours apart over each 24-hour period of the study. There was a point accuracy recorded and a rate accuracy recorded. A total of 1,104 readings were used to conclude that both tests had clinical accuracy. The overall correlation between the

Continuous Glucose Monitoring System and the Freestyle Navigator were similar: Continuous Glucose Monitoring System was .79 and the Freestyle Navigator was .84.

Klonoff (2005) compared intermittent and continuous monitoring of blood glucose levels in 11 diabetic patients. The five different methods used were the Continuous Glucose Monitoring System, the GlucoWatch, the GlucoDay, the Pendram, and the Freestyle Navigator. The Continuous Glucose Monitoring System showed the most accuracy. It allowed unrecognized hypoglycemia to be detected during the most important time, when sleeping. He concluded that the continuous glucose monitoring system offers advantages in identifying glucose direction, magnitude, duration, frequency and causes over intermittent glucose monitoring when glycemic patterns were poorly understood (Klonoff, 2005).

Franklin, Wilson, Bulter, & Greene (2005) had 11 patients in their continuous glucose monitoring system experiment to improve glycemic reading for diabetic patients. There were 7,960 paired blood glucose values, and from that the error having a positive mean of .35 mmol/l (95% confidence interval .22-.48mmol/l). The continuous glucose monitor system overestimated at low levels of blood glucose readings, and underestimated at high levels of blood glucose readings. Overall the monitor was classified as a useful tool to improve diabetes self-management and optimize glycemic control.

Maia and Araujo (2007) conducted a study to determine the accuracy of the Continuous Glucose Monitoring System and the efficacy of this method to detect unrecognized hypoglycemia and postprandial hyperglycemia in diabetes mellitus patients. There were 46 patients who participated. Maia and Araujo concluded that the

continuous glucose monitoring system is a reliable method for identifying glycemic excursions, postprandial hyperglycemia and improving metabolic changes in therapeutics of type 1 diabetes patients.

Blood Glucose Monitoring System: Special Populations

McLachlan, Jenkins, and O'Neal (2007) assessed the usefulness of the continuous glucose monitoring system in pregnant women with diabetes. This study was conducted to provide useful decision-making knowledge, and evaluate tolerability and perception of the continuous glucose monitoring system. The present way of evaluating glucose levels in pregnant women is the finger stick. Fifty-five participants with gestational diabetes were recruited and wore the continuous glucose monitoring system. Of the 55, there were 48 who finished the study. There was positive feedback from 37 of the 48, showing the Continuous Glucose Monitoring System was well-tolerated and clinically useful to the management of gestational diabetes and pre-existing diabetes in pregnancy (McLachlan, Jenkins, and O'Neal, 2007).

Charnogursky et al. (2005) presented a case study of a 20-year old female college student who needed to be evaluated for hypoglycemia. Her palpitations, blurred vision, and left facial parenthesis had all progressively worsened and occasionally become more frequent over time. Her symptoms occurred mostly during the hours of three and seven p.m. The continuous glucose monitoring system was applied and was monitored for 87 hours. The subject was asked to record, in a diary, her meals and physical activity. In this case, the continuous glucose monitoring system was effective in detecting insulinoma. The episodes of hypoglycemia during the night were frequent and recovery was

spontaneous. The continuous glucose monitoring system was shown to provide a good correlation between blood and interstitial glucose levels.

The purpose of a research study by Hay, Wilmshurst, & Fulcher (2003) was to evaluate the frequency and extent of hypoglycemia and hyperglycemia in elderly adults. The participants had well controlled type 2 diabetes. Patients were asked to use the continuous glucose monitoring system two times for a 72-hour session and then again one month later. Twenty-five patients were monitored. A daily diary of meals, exercise and other activities were recorded. The continuous glucose monitoring system was well tolerated, but only 52% were able to complete 288 hours of monitoring. In 8% of cases this situation related to factors independent of the study itself and 44% had difficulties managing the device. Some of the patients might have been able to handle the Continuous Glucose Monitoring System better with a longer and more detailed instruction period. Also, by having the participant come in for a trial period it could have increased the participants' success rate.

Nutritional Counseling

The American Diabetes Association (2008a) has made recommendations of nutrition interventions for diabetics. For the overweight and obese, the ADA suggests that either low-carbohydrate or low-fat, calorie-restricted diets can be effective in the short term (up to one year). Physical activity and behavior modification are important components of weight loss programs and are helpful in maintaining weight loss (medications for weight loss for type 2 diabetes may be considered and can help up to 5-10% when combined with lifestyle modification). Bariatric surgery continues to be studied with overweight and obese populations. For prevention of type 2 diabetes, the

ADA recommends structured programs that emphasize lifestyle changes that include moderate weight loss, regular physical activity, consultations for a recommendation for dietary fiber and food containing whole grains. There are no nutrition recommendations for preventing Type 1 diabetes. Important for controlling diabetes is the intake of carbohydrates, fat, cholesterol, protein, alcohol, and micronutrients. Nutrition interventions for diabetic women during pregnancy and lactation include adequate energy intake that provides appropriate weight gain during pregnancy; medical nutrition therapy is recommended for accurate weight gain, normoglycemia and absence of ketones. ADA recommended nutrition intervention for older people with diabetes is modest energy restriction and an increase in physical activity. A daily multivitamin supplement may be appropriate, especially for those older adults with reduced energy intake (ADA, 2008a).

For diabetics with micro-vascular complications, the ADA (2008a) recommendations are to reduce the amount of protein intake at earlier stages rather than later; medical nutrition therapy is also strongly recommended to have favorable effects on retinopathy and nephropathy. Diabetic individuals with cardiovascular disease, or at risk, should include diets high in fruits, vegetables, whole grains, nuts and reduce the sodium intake to less than 2,000 mg/day. Ingestion of 15-20 grams glucose is the preferred treatment for hypoglycemia, although any form of carbohydrate that contains glucose may be used. During acute illness insulin and oral glucose lowering medications should be continued, and drinking adequate amounts of fluids and ingesting carbohydrate are all important. Finally the ADA recommends that acute health care facilities establish an interdisciplinary team, implement medical nutrition therapy, and have a specific plan to improve the nutritional status of patients with diabetes during and after stay. The

American Diabetes Association (2008a) position statement concludes, "With all populations, monitoring of metabolic parameters, including glucose, A1C, lipids, blood pressure, body weight, and renal function is essential to assess the need for changes in therapy and to ensure successful outcomes."(p.20)

Another aspect of nutrition recommendations for individuals with diabetes concerns the glycemic index of carbohydrates. Rizkalla (2005) states "There are three classifications that investigators have found with carbohydrates. Complex carbohydrates, such as white bread, baked potato, and most flaked cereals, have a high glycemic index (greater than 70), rice and pasta have an intermediate glycemic index (55-69), and others such as legumes and pulses (lentils, haricot and kidney beans) have a low glycemic intake (less than 55)." (p.49) The amount of carbohydrates in one serving multiplied by the glycemic index of the food, allows comparisons of the likely glycemic effects of realistic portions of different foods. The American Diabetes Association has taken the position that there is no evidence that chronic consumption of low glycemic foods will contribute to improved glycemic control with people with diabetes. However reducing the amount of carbohydrate is of importance to diabetic patients (Rizkalla, 2005).

Toplak et al. (2007) conducted a study with 640 participants who were obese and had type 2 diabetes treated with metformin. All participants received a non-pharmacological program of diet, exercise and behavioral modification throughout the study. The study lasted 24 weeks. There was a placebo group, topiramate 96mg/day, or topiramate 192 mg/day. The focus of the program was on diet, exercise and self-management strategies delivered by counselors who worked one-on-one with the subjects. The subjects in the placebo group lost 1.7% of baseline body weight, subjects

receiving topiramate 96 mg/day lost 4.5% of baseline body weight, and subjects in the topiramate 192mg/day group lost 6.5% of baseline body weight. Topiramate subjects also experienced significant decreases in systolic blood pressure. The investigators concluded topiramate was effective for weight reduction and improvement in glycemic control in obese subjects with type 2 diabetes treated with metformin.

Physical Activity Counseling

A clinical question in the Cochrane review states: What should physicians tell patients with type 2 diabetes about the role of exercise? Will it improve the quality of life? Will it help reduce A1C, adiposity, and triglyceride levels? As previous studies have shown "Exercise, diet control, smoking cessation, and reduction of alcohol use are recommended lifestyle modifications for persons with type 2 diabetes." (Cayley, 2007, p.335) The Cochrane review provides strong evidence that exercise programs ranging in duration from eight weeks to one year reduce A1C levels by approximately 0.6 percent, as well as reducing adipose tissue and triglyceride levels. However, the studies reviewed did not provided sufficient evidence of improvement in quality of life, morbidity, or mortality, the length of time was not sufficient to evaluate changes in mortality rates, and there was minimal reporting of quality of life measures.

Educational Approaches

Communication

As research has shown, many diabetics have problems with control of blood glucose levels. There are several ways to improve control of glucose levels, but also several barriers that follow. Many people with diabetes have a fear of needles, which can be a barrier with people using insulin injections daily. Siminerio (2008) suggests

communication and education are the keys to overcoming psychosocial barriers to initiation of adherence in injectable therapies. A positive attitude is essential about the entire treatment from beginning to end. The patient may become more at ease towards the therapy (such as injections).

Good communication from a physician to the patient when providing verbal information about education tools is critical. This will affect the diabetic's attitude and beliefs to determine what the therapy will entail in the future. Involving the patient about self-care is also pertinent while improving better adherence and clinical outcomes. Two major roles are goal setting and other behavioral changes (Siminerio, 2008). Overall, the physician and diabetic patient need to work together to obtain optimal glycemic control.

Cavanaugh, White, & Rothman (2007) stated that " by evaluating the experience in diabetes management we have learned that onsite diabetes disease management programs have demonstrated improvement of patient outcomes and are characterized by providing an opportunity to engage patients of all risk levels in quality care, maximizing the individual patient provider relationship, collaborating in an environment that allows for the efficient transmission of information between team members, and supporting the electronic medical record and other associated information technology advances." (p. 79) The healthcare systems want to provide the highest quality of care which calls for continuous self evaluations and up to date information to gain the most recent knowledge.

Positive Influences

Rapley, Passmore, and Phillips (2003) explained that psychometric properties have positive influences for education tools. For example, self-efficacy is a powerful behavioral determinant that can be targeted by educational self-management programs in

general and used by diabetes educators with individuals for more specific remedial strategies. Targeting individuals with a low efficacy belief related to diabetic routines, to self-treatment strategies, to diet or to exercise is crucial not only for the initial behavior change but also for that change to persist.

Intervention Techniques

A study was conducted by Reed, Revel, Carter, Saadi & Dunn (2001) to see if an intervention clinic for people with diabetes would prove to be a successful way of providing diabetes care. This study had six intervention clinics set up in the Arabian Gulf offering a multifaceted intervention composed of a chronic care diabetes clinic, a diabetic flow chart, and educational programs for clinic nurses, doctors, and patients. There were 219 subjects and they were tested to determine if their education levels improved throughout 12 months of receiving education. The intervention included implementation of generalist-based diabetes chronic care, a patient education program, a provider education program, and improved recording of clinical information. These were successful in improving adherence to diabetes guidelines and increased some aspects of satisfaction with diabetes care. There was no significant improvement in clinical outcomes, but changes noted were in the expected direction of improvement. The significant improvements in adherence to diabetes guidelines suggest that this intervention is a promising model for diabetes care for newly developed countries (Reed, et al., 2001).

Mensing and Norris (2003) stated: " Educators and learners involved in group education have unique opportunities to learn, offer new perspective, try out alternative strategies, share creativity, and work together to evolve optimal learning strategies" (p.

100). There are four skills stated that are necessary for a group teacher to be effective: preparation, development of delivery options created to enhance subject content (e.g. demonstrations, discussions, visits to real world settings), assessment of learners, and using appropriate and timely documentation.

> Mullen, Green, & Persinger (as cited in Mensing & Norris, 2003)
>
> Performed a meta-analysis of educational programs for care with chronic conditions whose care included pharmacotherapy. Educational techniques were examined, including, one-to-one counseling, group education, written and other audiovisual materials, patient package inserts, counseling or group education plus materials, and behavior modification. They found that, for patient knowledge about their medications, significant improvements were noted for one-to-one counseling, group education, and written and other audiovisual materials. Patients' ratings of educational quality were the strongest predictor of knowledge regardless of whether an individual or group format was used (p. 97).

Messing and Norris (2003) compared group and individual education in a narrative fashion, concluding that research literature in diabetes education is divided, although effects may be more positive for group delivery of a lifestyle program (intervention focusing on diet and physical activity) than for individual programs. Teaching self-care skill was effective both in group and individual setting. These studies conclude individual and group education may be equally effective in helping those with diabetes mange their self-care.

Another study examined assessment of group versus individual diabetes education. Rickeim, Weaver, Flader, & Kenall (2002) randomized 170 subjects with type

2 diabetes into two groups. Over a six month period one group of 87 subjects received group education and the second group of 83 subjects received individual education. The outcomes that were looked at were knowledge, self-management behaviors, weight, BMI, HbA, health-related quality of life, patients' attitudes, and medication regimen. Both educational settings resulted in similar improvements in knowledge, BMI, health -related quality of life, attitudes, and all other measured indicators. HbA decreased from 1.8% to 0.8% at 6 months in the study population as a whole. For the individual setting HbA showed a 1.9% reduction and for the group setting HbA had 1.8% reduction. Therefore they concluded that diabetes education delivered in a group setting when compared with an individual setting was equally effective at providing equivalent or slightly greater improvements in glycemic control (Richeim et al., 2002).

Roter, Hall, Merisca, Nordstrom, Cretin, & Svarstad (1998) focused on effective intervention to improve patient compliance with medical regimens. This study was a meta-analysis of 153 articles from the years 1977 to 1994. The findings indicated that large effects were evident for indirect measures (e.g. pill count and refill records) of compliance among patients with diabetes. Inspection of individual finding showed that the interventions had their effect exclusively on behavior. The meta-analysis also showed benefits from interventions in direct compliance measures (both weight loss and blood test measures) and in self-reported compliance. These were no single strategy or programmatic focus that showed any clear advantage compared with another. Comprehensive intervention combining cognitive, behavioral, and affective components were more effective than a single-focus intervention (Roter et. al, 1998).

When it comes to educating people about their diabetic conditions, it is important to educate not just the parents or individuals who are older but also the young children who are diagnosed with either type 1 or type 2 diabetes. Knowles et al. (2006) stated:

> The recent document from Diabetes UK and the Department of Health highlights a gap in the delivery of such education to children and adolescents and provides specific quality standards for education programs namely that they should be evidence-based and have very clear aims and objectives which will enable the patient to learn within an environment that is conducive to his/her personal learning needs; be delivered by suitably trained educators, be structured, quality-assured and audited. (p. 323)

As previously stated, evidence-based, structured education is recommended for all people with diabetes. The earlier patients are informed about their condition, the more control they will have over their disease. Knowles' study focuses on children and adolescents with the following: diet, insulin management, hyperglycemia, living with diabetes, and parent education. Knowles' study concluded that collaborative work between health professionals, school teachers and families has resulted in an age-appropriate curriculum, which employs validated educational techniques.

Renders, Valk, Griffin, Wagner, Eljk Van, & Assendelft (2001) focused on understanding the best way to narrow gaps between what is known to be effective in diabetes care and the care that is currently provided in primary care, outpatient, and community settings. Information gathered was on studies that evaluated the effectiveness of interventions directed at health care professionals who care for non-hospitalized patients with type 1 and type 2 diabetes in primary care, outpatient and or community

settings. The interventions were targeted at health care professionals in studies and organization of care in nine studies. Complex professional intervention improved the process care, but the effect on patient outcomes remained less clear because such outcomes were rarely assessed. The patient education was enhanced because the nurse added improvements to the patients' outcome and process of care. In conclusion, the multifaceted professional interventions and organizational interventions that facilitated structured and regular review of patients were effective in improving the process of care (Renders et al., 2001).

Adolescent Care

Dovey-Pearce, Doherty, & May's (2007) study focused on an adolescent care plan devised in early adolescence and periodically reviewed and expanded in line with the person's development. Such a plan could easily cover issues such as educational and vocational aspirations, social commitments, hobbies, family life relationships, and diabetes knowledge (self care) behaviors. The care plan would "focus on minimizing the impact of diabetes upon these other life-areas and looking to link the young person with other support services (e.g. school, community-based resources, social services, and other health services) as appropriate" (p. 88). Dovey-Pearce, et al. (2007) concluded that health care services need to support young people with self-care, but must also understand and respond to the social and personal complexities of growing-up with a long-term health condition.

Becoming Educated

Chodosh, et al. (2005) assessed the effectiveness and essential components of self-management programs for hypertension, osteoarthritis, and diabetes mellitus. There

was a meta-analysis completed of 780 studies focusing on chronic disease self-management characteristics: tailoring, group setting, feedback, psychological emphasis, and medical care. The average length of intervention was about three months. The outcomes stated in Chodosh, et al. (2005) meta-analysis "concluded for chronic disease self-management programs for older adults probably result in clinically and statistically significant improvements in blood glucose control and blood pressure control, although this evidence is tempered by our findings of possible publication for these two outcomes" (p. 436).

Becoming educated about any disease is important especially if it is affecting oneself. Muramoto, Campbell, & Salazar (2003) present several ways of educating people with disease such as electronically-based methods to inform adults about education, problem based learning, competency based training, face to face education, audio or videotape instruction, satellite broadcasting, E-mail, internet streaming, etc. Muramoto et al. (2003) stated that there is no single best solution. Designing a training program for appropriate education must take into consideration various characteristics of the desired program as well as the target audience.

The article by Skinner, Cradock, Arundel, & Graham (2003) reports a development on a series of self-management education workshops for individuals newly diagnosed with type 2 diabetes. There were four goals for the workshops: "to provide individuals with information regarding the causes, effects and management of type 2 diabetes; to enable newly diagnosed individuals to discuss and explore their experiences, frustrations, and successes in living with diabetes; to ensure that those living with type 2 diabetes are aware of their specific health risks for developing the complications of

diabetes; to support individuals in developing their own diabetes management plan." (p.75). The philosophies revolved around informed choice based on humanistic view of individuals of each participant.

The workshop was set up based on four different theories, Self-Regulation focusing on individuals illness representation or personal model of diabetes as a key determinant of their behavioral and emotional responses to illness; Dual Process Theory focuses on the process of education and addressing individuals current understating of diabetes; Self-Determination Theory focuses on the difference between controlled (doing things for extrinsic reasons) and autonomous (doing things for intrinsic reasons) motivation; and Social Learning Theory focuses on individual perceptions of their ability to enact behaviors and follow through on action plans. The sessions focused on the specific individual's situation trying to tailor a plan after the workshop is completed to have successful outcomes. Skinner, et al. stated "The workshops are now embedded into routine care provided by the Portsmouth Trust and, being run in a local community center, are accessible to all individuals. They are cost effective and financially sustainable, cost about $80(US) per person including refreshments and lunch, staffing, room rental fees, and stationery. Initial evaluation indicates these workshop results in significant changes in self-management behavior and are accompanied by significant reduction in hemoglobin A, total cholesterol, and body mass index" (p 80) This is a beneficial program and future studies need to be completed on the effectiveness of a workshop.

Cultural Barriers to Diabetes Education

Many people who are not getting the proper attention they need for diabetes are thought to not care about stabilizing their glucose levels, but the real cause may be cultural barriers. Gavin and Wright (2007) found cultural barriers are definitely an issue when it comes to health care of African Americans with type 2 diabetes. They state, "A disconnection exists on several levels, including health beliefs, nutritional practices, religious beliefs and practices, interactions with the health care system, and socioeconomic issues" (p.14). External influences in this racial group include some of the following: obesity is accepted as the norm, type 2 diabetes can be hereditary and cannot be prevented, and economic barriers (cost of medication and supplies).

Brown and Harris (1999) completed a study on Mexican Americans focusing on type 2 diabetes. The methods consisted of five things: community assessment, intervention design and educational materials, selection or development of outcomes, pilot testing of intervention in the target community, and testing of full intervention with a randomize, controlled clinical investigation. Brown and Harris wrote:

> The poorest county in Texas and one of the poorest in the US, Starr County, a Texas-Mexico border community, has the highest diabetes-related death rate in Texas; 97% of the residences are Mexican American and 50% of the Hispanic population over the age of 35 either have diabetes or are first-degree relatives of someone with diabetes. Starr County serves as an excellent clinical laboratory for testing health promotion interventions for Mexican Americans. (p. 227)

The Starr County study showed true representation for several cultural barriers. After all the education (videos and pamphlets translated, bilingual intervention team, support

groups, dietary counseling, weekly meeting, etc.) that was received by the 247 participants (the population of Starr County was 365 people), weight reduction, fasting blood glucose levels declined, and glycosylated hemoglobin decreased. Brown and Harris concluded:

> Reduction of the HbA levels was achieved with an underserved population characterized by extreme poverty, little education and low literacy rates, and exceedingly high rates of Type 2 diabetes. This reduction required that investigator assist study participants in overcoming a number of barriers such as providing transportation and supplying glucometers and strips/lancets for home glucose monitoring. Understanding the effect of such strategies is essential for identifying potential causal links between effective interventions and health outcomes in underserved populations at high risk for developing diabetes. (p. 235)

This study proves that even with barriers in several different aspects of people's lives, it is still possible to have positive results to improve someone's life with diabetes.

Campos' (2007) study focused on Hispanics with diabetes. Hispanics experience a higher rate of diabetes than non-Hispanic whites and tend to have worse glycemic control and a greater risk of diabetes-related complications. Barriers listed in the Campos' study include socioeconomic issues (cost, insurance, and status), language difficulties, poor health literacy, and cultural beliefs that impact the patient-provider relationship and negatively affect patients' perceptions of diabetes and insulin. Campos (2007) stated "Many Hispanic patients with diabetes feel that their disease is a punishment from God, and they can do little to alter their fate. Such beliefs may hinder a patient's ability to successfully manage their disease" (p. 814). In this case, having a

strong, positive communication relationship between the provider and patient is crucial to explain the risk they are taking by not getting the appropriate health care. If people do not have health insurance or Medicare/Medicaid coverage, out of the pocket expenses can become very high leading to people not buying the appropriate medication to stabilize their blood glucose levels. These concerns are for not only diabetics who are Hispanic or African American, but for everyone with all health care problems. It is essential that people have appropriate resources to optimally get their disease under control.

Sarkisian (2003) stated:

> the American Diabetes Association treatment guidelines for patients with diabetes recommend that self-management training, in which patients learn how to control and monitor their diabetes, be an integral part of the care plan. Several excellent reviews of diabetes self-management education programs have been conducted in the past 10 years. From these we have learned that self-management education programs are associated with improved knowledge and, to a variable degree, improved biophysical markers of health (eg. weight and glycemic control) and psychosocial markers of health (eg, self-reported quality of life); and the most successful interventions are ones that aimed to change actual behavior rather than merely increase knowledge. The extent which interventions have been effective (or ineffective) among specific ethnic or age groups was not explored in previous reviews. (p. 468)

One would suggest that each person with diabetes should go through the self-management training and view the possibilities of gaining benefits with controlling their diabetes.

Anderson-Loftin, et al. (2005) focused on the southern African-American cultural nutrition factors by using the culturally competent dietary self-management intervention with people facing type 2 diabetes. The study was located in South Carolina which had among the highest prevalence of diabetes, overweight, and obesity in the nation. The education approach used was weekly nutritional classes in low fat dietary strategies, monthly peer-professional group discussion, and telephone follow up. Each approach used reflected ethnic beliefs, values, custom, food preferences, language, learning methods, and health care practices among southern African-Americans. After six months, investigators tested fasting blood samples for lipids, A1C, weight measurements, and a FHQ assessed dietary behavior changes. The body mass index and dietary fat behaviors were significantly lowered, weight decreased 3.7 kg, and high-fat dietary habits were reduced to moderate levels while a trend in reduction of A1C and lipids was observed. It was concluded that culturally competent dietary self-management intervention will improve health outcomes for southern African Americans with type 2 diabetes.

Conclusion

This literature review has found several positive and negative ideas for each diabetes education tool studied. The overall conclusion is that the National Standards for diabetes self-management education are key components in diabetes education. The multidisciplinary team is a great way to educate the diabetes population as stated in the National Standards. There are several cultural barriers that make it difficult for people with diabetes to cope with their disease. If there were ways to mandate that every person diagnosed with diabetes needed to receive adequate education, it would make for a healthier diabetic population.

CHAPTER III

METHODOLOGY

The purpose of this study is to compare the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and helping patients identify causes of suboptimal control of blood glucose. Patient educational tools compared included verbal information from a physician, consultations with a dietician, sessions with a diabetes educator, written materials such as pamphlets or brochures, Internet sources of information, of finger stick glucose monitoring, and use of the Continuous Glucose Monitoring System.

Convenience Sample

To qualify for the study, participants must have been diagnosed with type 1, type 2, or gestational diabetes. The participants consisted of administrators and teachers in the Chicago District 218 (Richards High School, Shepard High School, and Eisenhower High School), District 118 (Palos South), and Bloomington Unit Five District (Normal Community West High School). They also included patients contacted by a Medtronic MiniMed representative who worked with patients in the southwest suburban area of Chicago.

Data Collection

Participants from the school districts were contacted by e-mail from their principals. The researcher e-mailed the cover letter (Appendix A) to the principals and then the principals forwarded it to all faculty and staff. The representative from Medtronic MiniMed was also given the cover letter to forward to potential participants

who have diabetes. If the contacted individuals chose to complete the survey (Appendix B), they followed the directions in the cover letter to the website containing the survey.

Research Design

Each participant received an email (Appendix A) explaining the study and asking if he/she would like to participate. Participants were given a link to the website where the survey (Appendix B) was located at www.myq3.com. Completed surveys were placed in an anonymous mailbox accessible to only the investigator. The surveying took place from February 1 to March 31, 2008.

Survey Instrument

Survey questions were designed to help compare the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and helping patients identify causes of suboptimal control of blood glucose. Some questions that were asked included: What type of education have you received after being diagnosed a diabetic? After receiving education about your diabetic condition, has your diet changed? After receiving education about your diabetic condition, are you aware of changes in your glucose levels while you are sleeping?

Data Analysis

The information from each question was analyzed by diabetes types (type 1, type 2, and gestational diabetes), gender (female and male), and age groups (18 years and younger, 19-25 years old, 26-39 years old, and 40-78 years old). SPSS Version 14.0 software was used to obtain descriptive demographic information and frequency tables

displaying responses to each survey question for each of the comparison groups.

CHAPTER IV

RESULTS

The purpose of this study was to compare the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and in helping patients identify causes of suboptimal control of blood glucose. Participants completed an on-line survey that asked questions about educational tools such as consultations with a dietician, sessions with a diabetes educator, verbal information from a physician, written materials such as pamphlets or brochures, Internet sources of information, use of the Continuous Glucose Monitoring System, and use of finger-stick glucose monitoring.

Subject Demographics

One hundred individuals with diabetes responded to the survey, 63 females and 37 males. The age range was from 14 to 78 years (mean age = 32.5 years, SD = 14.4). There were 60 respondents, 33 female and 27 male, with type 1 diabetes. Their ages ranged from 14 to 56 years (mean age = 26.9 years, SD = 9.97). Twenty-eight subjects, 17 female and 11 male, had type 2 diabetes. Their ages ranged from 22 to 78 years (mean age = 47.6 years, SD = 15.2). Ten women reported having gestational diabetes. Their ages ranged from 26 to 34 years (mean age = 29.8 years, SD= 2.8). One person did not know the type of diabetes and one person did not answer that question.

Table 1 shows the types of diabetes found within four age groups. One hundred percent of the survey respondents age 18 and under had type 1 diabetes. In the group of 19-25 year olds, 90% were type 1 diabetics and 10% had type 2 diabetes. In the age group 26-39 years old, 54% had type 1 diabetes, 21% had type 2, and 26% were

gestational diabetics. In the oldest group, 40-78 years old, 32% were type 1 diabetics and 68% had type 2 diabetes.

Table 1. Breakdown of diabetes type by age group (Number of subjects)

	< 18 yrs old	19-25 yrs old	26-39 yrs old	40-78 yrs old
Type 1	13	19	21	7
Type 2	0	2	8	15
Gestational	0	0	10	0

Survey Results

Blood Glucose Control

Table 2 shows the responses to the question, " At follow up visits, has your doctor told you that you need to have better control over your blood sugar levels?" Fifty-eight percent of the type 1 diabetics reported they needed better control, 71% of type 2 diabetics needed better control, and 56% of the gestational diabetics needed more control. This is a significant percentage in all diabetic populations that need more control indicating that there is a need for more education for all of the participants in this study.

Table 2. Need for better control shown by type of diabetes (Number of respondents)

	Type 1 Diabetes	Type 2 Diabetes	Gestational Diabetes
Yes	35	20	5
No	25	8	4

Table 3 shows the response to this question broken down by gender. There is only a two percent difference between males and females; 62% of females feel they needed better control and 60% of males. Inadequate control over blood glucose levels seems to be problematic for both men and women.

Table 3. Need for better control shown by gender (Number of respondents)

	Female	Male
Yes	38	23
No	23	15

From the responses presented in Table 4, it can be seen that the percentage of respondents needing to improve blood glucose control increases with age. For ages 18 years and younger, 47% indicate needing better control; for ages 19-25 years old, 57% needed better control; ages 26-40 years old, 63% needed better control; and ages 40-78 years old, 68% needed better control.

Table 4. Need for better control shown by age (Number of respondents)

	< 18 yrs old	19-25 yrs old	26-40 yrs old	40-78 yrs old
Yes	7	12	24	15
No	8	9	14	7

Blood Glucose Monitoring

Of the 100 participants, 34 people indicated that they check their sugar levels five or more times daily, 17 people check their sugar levels four times daily, 14 people check their sugar levels three times daily, 13 people check their sugar levels two times a day, 14 people check their sugar levels one time a day, and 8 people do not check their sugar levels daily.

Figure 1 shows the number of times a day subjects check their blood glucose levels broken down by type of diabetes. Subjects with Type 1 diabetes reported checking blood sugar most frequently: 30 subjects check five or more times per day and 11 subjects check four times per day.

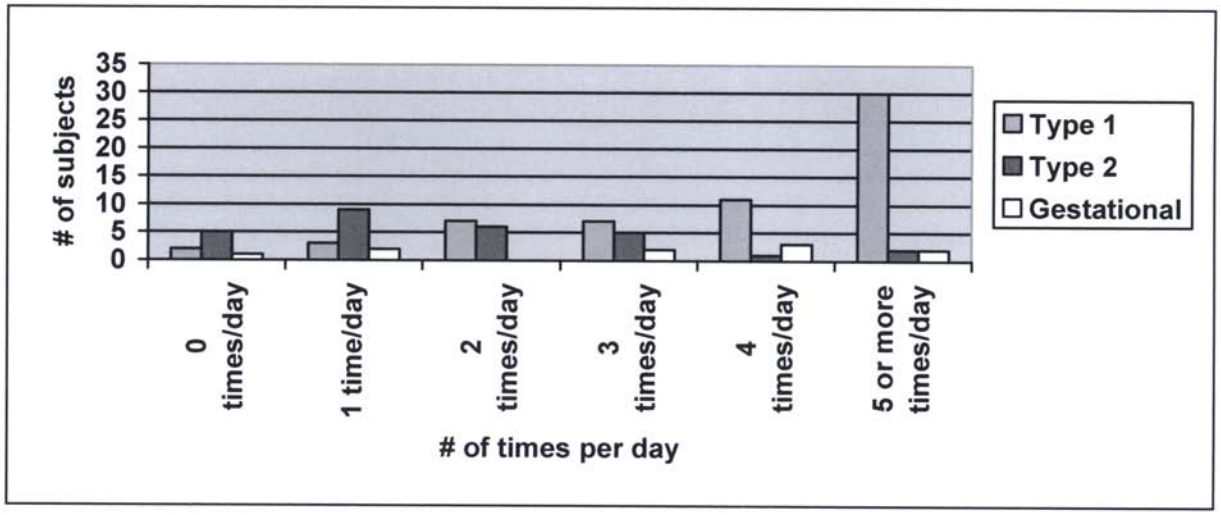

Figure 1. Number of times per day blood glucose is checked (Types)

Figure 2 compares the frequency of blood glucose checks of female and male respondents. The percentage of females (38.7%) is higher than males (26.3%) that check their glucose levels five or more times a day.

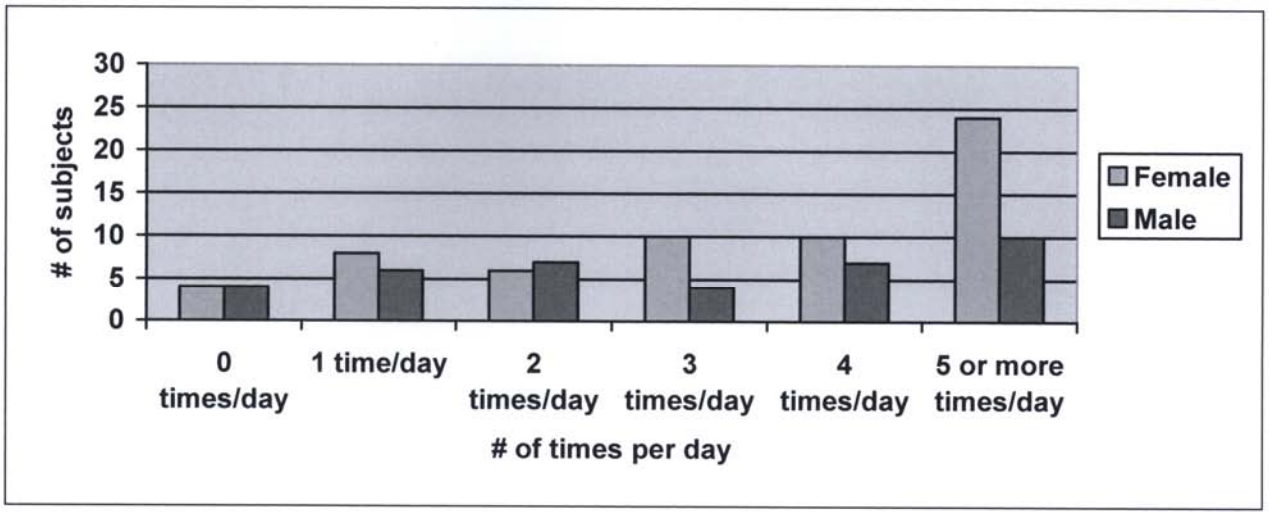

Figure 2. Number of times per day blood glucose is checked (Gender)

In Figure 3 the responses about blood glucose monitoring are broken down by age groups. The age group 18 years and younger has the highest percentage when checking glucose levels 5 or more times a day (46%), compared to age group 26-40 years old at 41% , 19-25 years old at 28.6% ,and 40 -78 years old at 22.7%

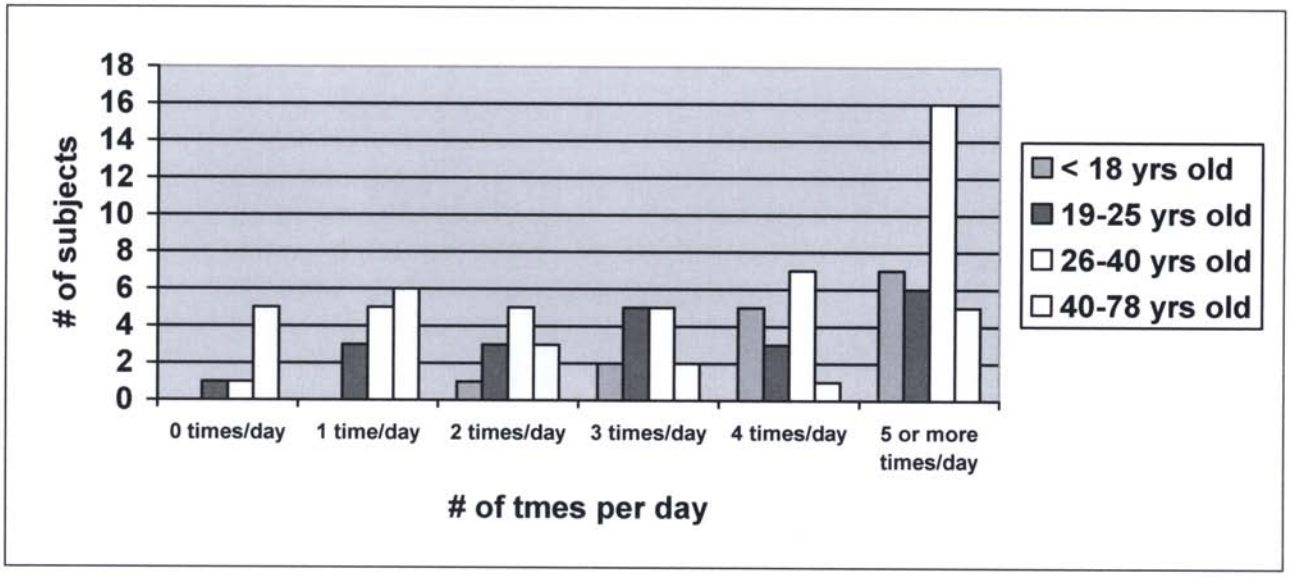

Figure 3. Number of times per day blood glucose is checked (Age)

Patient Education

Participants were asked what types of diabetes education they had received after being diagnosed with diabetes. The most frequent was verbal information from a consultation with a physician (94 of 100 subjects). The second most frequent was consultation with a dietician, which was checked by 82 subjects. Third was written materials such as pamphlets or brochures, which was checked 81 times, followed by consultation with a diabetic educator, which was checked 69 times. The fifth most popular education received was internet sources of information, which was checked 66 times. The sixth most popular education received was continuous glucose monitoring system, which was checked 53 times. The seventh most popular education received was something other than the suggested list such as diabetes summer camps, diabetes support groups, personal research, and magazine articles, which was checked 7 times. One participant indicated that none of these forms of patient education was received.

Ninety-six of the one hundred respondents indicated that they had received more than one type of diabetes education. Seven people checked two types of education received after being diagnosed with diabetes. Twelve people had selected three types of education received after being diagnosed with diabetes, while seventeen people had participated in four types of education. Thirty-one people indicated five types of education received, twenty-seven people received six types of education, and two people indicated participating in seven types of education after being diagnosed with diabetes.

Table 5 represents the types of education participants received since being diagnosed with diabetes, broken down by diabetes type. The most frequent education received by both type 1 and type 2 diabetics, as well as those with gestational diabetes, was a consultation with a physician. The least frequent (besides none) for all groups was the continuous glucose monitoring system (CGMS).

Table 5. Types of education received shown by type of diabetes

	Physician	Dietician	Diabetes Educator	CGMS	Written Materials	Internet	None
Type 1	58	52	45	35	49	41	1
Type 2	27	20	16	11	22	16	0
Gestational	7	9	7	5	8	8	0

Table 6 represents what type of education male and female participants received since being diagnosed with diabetes The most frequent education received by both females and males was verbal information from a physician. The least frequent, besides none, for both females and males is the continuous glucose monitoring system.

Table 6. Types of education received shown by gender

	Physician	Dietician	Diabetes Educator	CGMS	Written Materials	Internet	None
Female	58	52	44	35	52	42	0
Male	36	30	25	18	29	24	1

Table 7 shows the types of education received since being diagnosed with diabetes, broken up into four different age groups (18 years old and under, 19-26 years old, 26-40 years old, and 40-78 years old). The most frequent education received in 18 years old and younger was verbal information from a physician and a consultation with a dietician. The most frequent education received in age groups 19-25 years old, 26-39 years old, and 40- 78 years old was verbal information from a physician.

Table 7. Types of education received shown by age group

	Physician	Dietician	Diabetes Educator	CGMS	Written Materials	Internet	None
18 & under	13	13	10	9	11	8	1
19-25 yrs old	21	19	17	11	18	13	0
26-39 yrs old	35	33	28	23	29	28	0
40-78 yrs old	22	15	12	8	21	16	0

Impact of Patient Education

Respondents were asked which type of education had the most impact. Of the 100 participants who filled out the survey, 35 participants indicated that a consultation with a diabetic educator had the most overall impact. Second, with 21 participants checking it, was verbal information from a physician. Third, there were 15 participants who checked consultation with a dietician. Fourth, there were nine participants who checked CGMS. Fifth were both written materials such as pamphlets or brochures and internet sources of information were checked by seven people. Lastly, two people checked none of the above

and three people checked other. The category of other included talking with other diabetics, clinical studies, and diabetes training camps recommended by doctors.

Table 8 displays the types of patient education which had the most impact on respondents with Type 1, Type 2, or gestational diabetes. Type 1 and gestational diabetics indicated that a consultation with a diabetic educator had the most impact. Type 2 diabetics chose consultation with a dietician to have the most educational impact.

Table 8. Education with the most impact shown by type of diabetes

	Physician	Dietician	Diabetes Educator	CGMS	Written Materials	Internet	None
Type 1	13	5	24	7	3	4	1
Type 2	6	8	6	2	4	2	0
Gestational	2	1	5	0	0	1	1

Table 9 shows responses by male and female respondents as to which type of diabetes education had the most impact. A consultation with a diabetes educator was the most frequent response, although men also felt information from a physician had impact.

Table 9. Education with the most impact shown by gender

	Physician	Dietician	Diabetes Educator	CGMS	Written Materials	Internet	None
Female	10	8	24	7	5	3	2
Male	11	7	11	3	2	4	0

As seen in Table 10, there were some differences in response to this question among the various age groups. The type of education selected most often in < 18 years old, 19-25 years old, and 26-39 years old was a consultation with a diabetes educator. The type of education selected by 40-78 years old was more varied, with verbal information from a physician, a consultation with a diabetes educator, and written materials such as pamphlet or brochures each selected by five survey respondents.

Table 10. Education with the most impact shown by age group

	Physician	Dietician	Diabetes Educator	CGMS	Written Materials	Internet	None
18 & under	1	3	7	2	0	1	0
19-25 yrs old	7	2	9	0	0	2	1
26-39 yrs old	8	6	13	5	2	3	1
40-78 yrs old	5	3	5	2	5	1	0

Lifestyle Changes

Diet. Study participants were asked the question "After being diagnosed with diabetes, did you change your diet?" Overall 74 out of 100 participants indicated that they have changed their diet.

Table 11 displays responses to this question broken down into type 1, type 2, and gestational diabetes groups. Sixty percent of type 1 diabetics changed their diet. Ninety-

three percent of type 2 diabetics changed their diet. One hundred percent of gestational diabetics changed their diets.

Table 11. Diet changes after diagnosis shown by type of diabetes

	Yes	No
Type 1	36	24
Type 2	26	2
Gestational	10	0

Table 12 displays responses to the question broken down into male and female. Seventy-nine percent of females changed their diet. Sixty-six percent of males changed their diet.

Table 12. Diet changes after diagnosis shown by gender

	Yes	No
Female	49	13
Male	25	13

The responses of the different age groups are displayed in Table 13. Sixty percent of the age group 18 and under changed their diet. Fifty-seven percent of the age group 19-25 years old changed their diet. Seventy-eight percent of the age group 26- 39 changed their diet. Ninety-five percent of the age group 40-78 years old changed their diet. The older the participants the more likely they were to change their diets.

Table 13. Diet changes after diagnosis shown by age

	Yes	No
< 18 yrs old	9	6
19-25 yrs old	12	9
26-39 yrs old	30	9
40-78 yrs old	21	1

Survey participants were also asked the question "What has changed about your diet?" As shown in Figure 4, overall 38% of the participants changed their diet by having less sugar, 22% ate less starch, 19% ate less fat, and 11% consumed less alcohol.

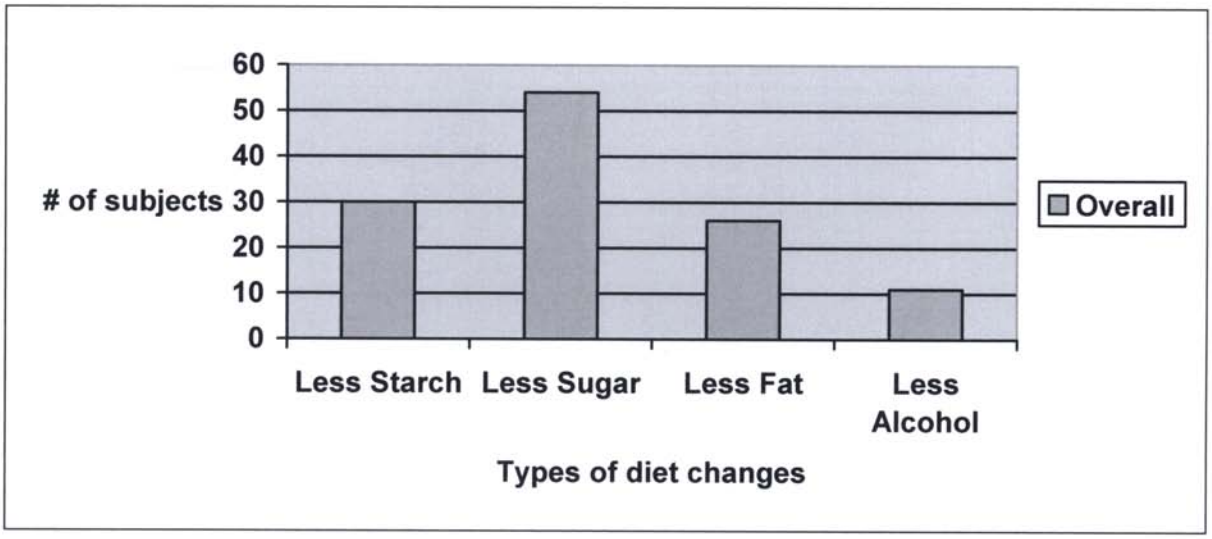

Figure 4. Dietary changes made after diagnosis with diabetes

In Figure 5 the dietary changes made by type 1, type 2, and gestational diabetics are shown. The biggest difference with all three groups is less sugar. The least changed with all groups was the amount of dietary fat. Other dietary changes mentioned by respondents were counting carbohydrates, portion control, control/better balance of carbohydrate/protein/fat in order to smooth glucose curve over time, more fiber, whole grain and less salt, moderation, and smaller amounts

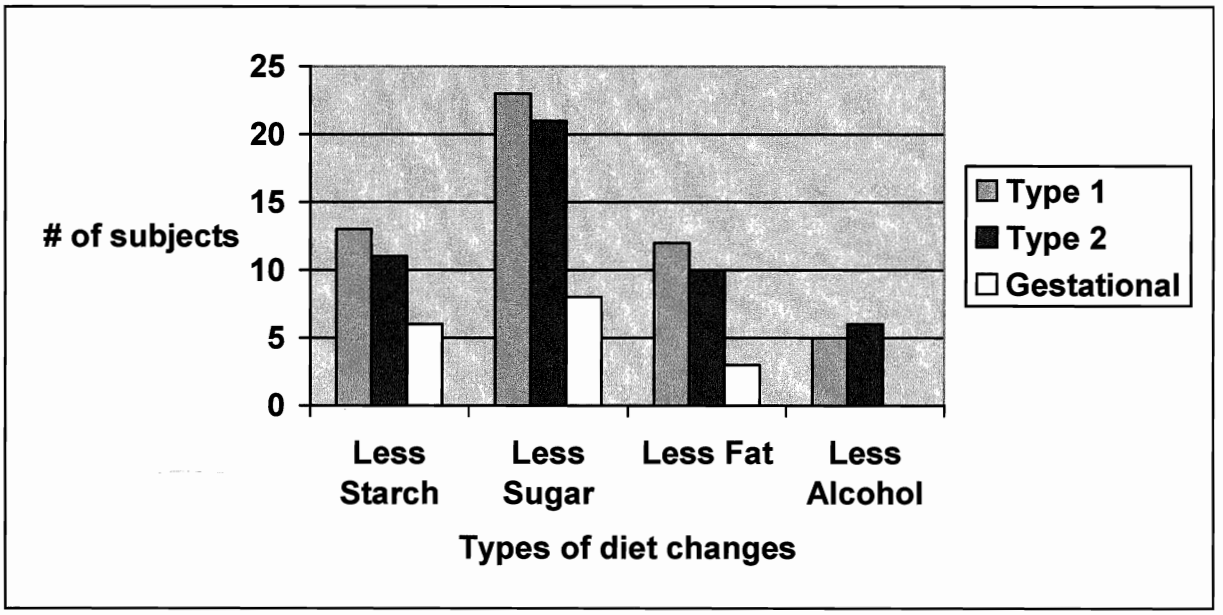

Figure 5. Dietary changes broken down by type of diabetes

The dietary changes made by male and female survey participants are displayed in Figure 6. The biggest change that was made by both males and females was less sugar. The least popular change made by both female and male subjects was less alcohol.

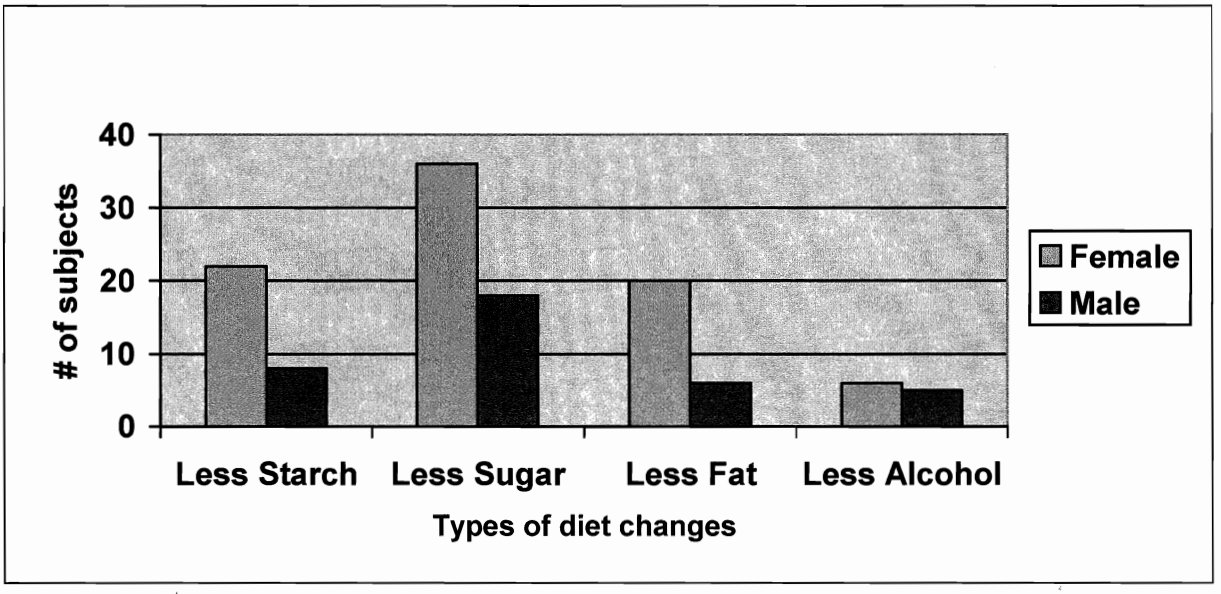

Figure 6. Dietary changes broken down by gender

As shown in Figure 7, the biggest change in diet that was made by all age groups was less sugar. The least popular change made by all age groups was less alcohol.

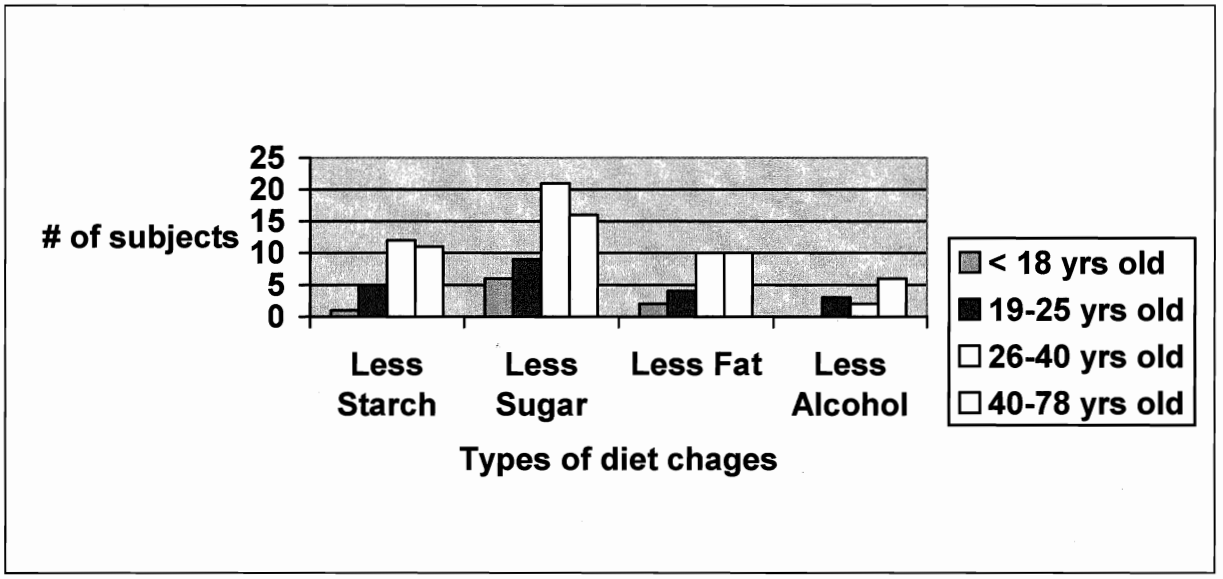

Figure 7. Dietary changes broken down by age group

Weight. In figure eight are displayed the responses of the overall results to the question "Has your weight changed since being diagnosed with diabetes?" Overall 33 participants (45%) had a weight loss, 25 participants (35%) had no changes in their weight and 14 participants (19%) had weight gain.

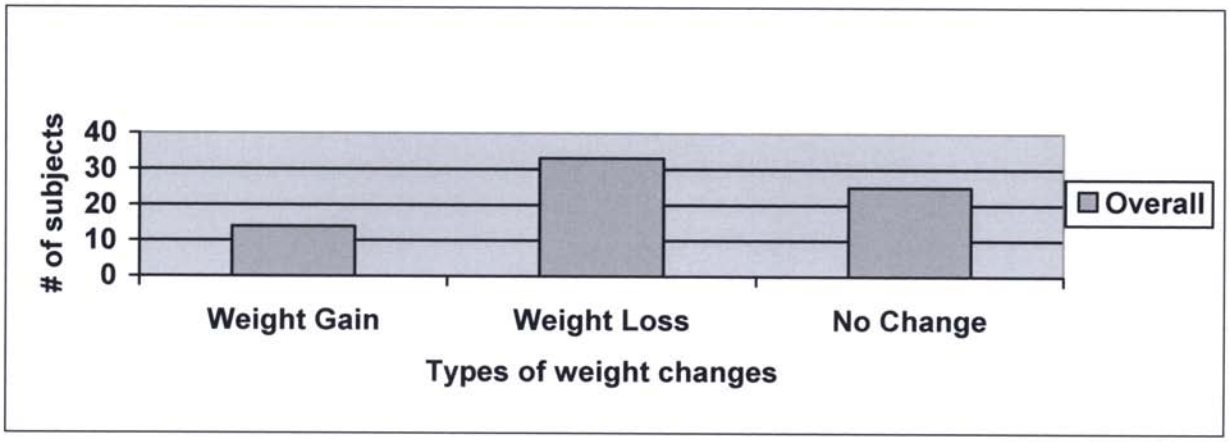

Figure 8. Weight changes after being diagnosed with diabetes

Figure 9 displays the weight changes of the different diabetic groups since being diagnosed with diabetes. The biggest change for type 2 and gestational diabetics is weight loss. Most type 1 diabetics' did not have any changes to their weight. For type 1 diabetics, 32% had weight gain, 21% had weight loss, and 50% had no change. For type 2 diabetics, only 8% had a weight gain, 76% had weight loss, and 16% had no change. Ten percent of gestational diabetics had a weight gain, 60% had weight loss, and 3% had no change.

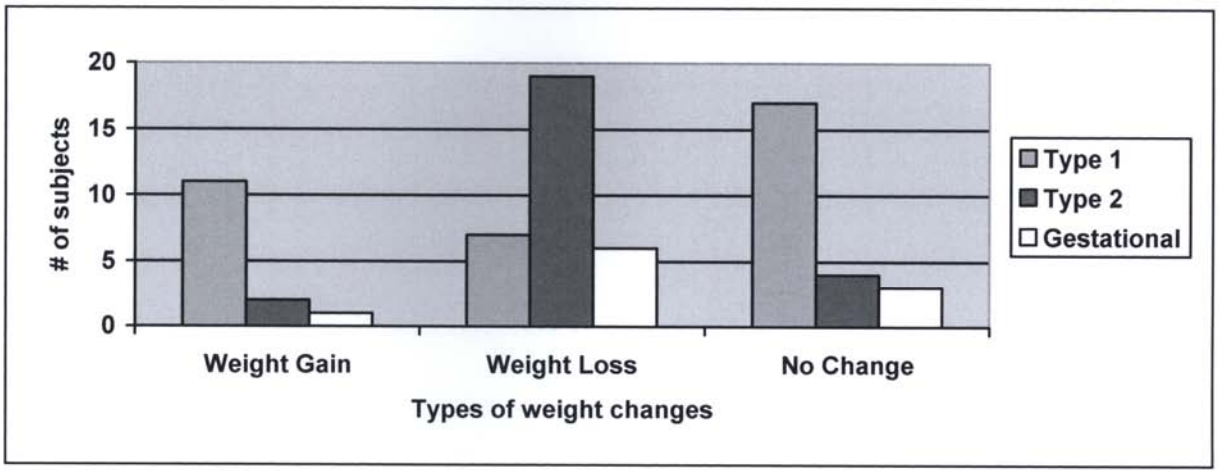

Figure 9. Weight changes shown by type of diabetes

Figure 10 displays weight changes participants experienced once diagnosed with diabetes broken in two different groups: males and females. The most frequent change for both female and male is weight loss. Seventeen percent of females had a weight gain, 49% had weight loss, and 34% had no change in weight. Twenty-four percent of males had a weight gain, 40% had weight loss, and 36% had no change.

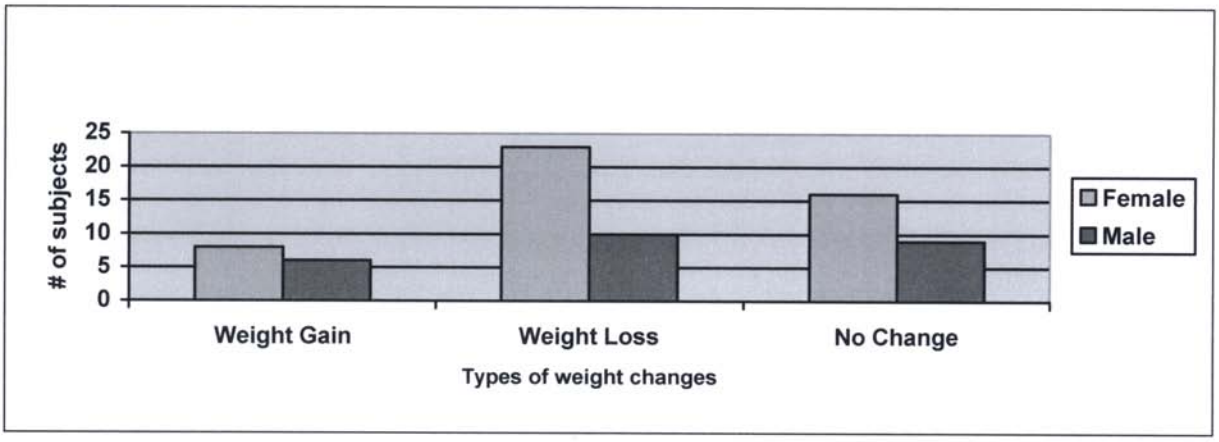

Figure 10. Weight changes shown by gender

In Figure 11 the weight changes since participants were diagnosed with diabetes are shown for the various age groups. The biggest change in the ages 40-78 years old and 26-40 years old was a weight loss. The biggest change in 19-25 years old was weight loss or no change. The biggest change in 18 years old or younger is a weight gain, probably due to growth.

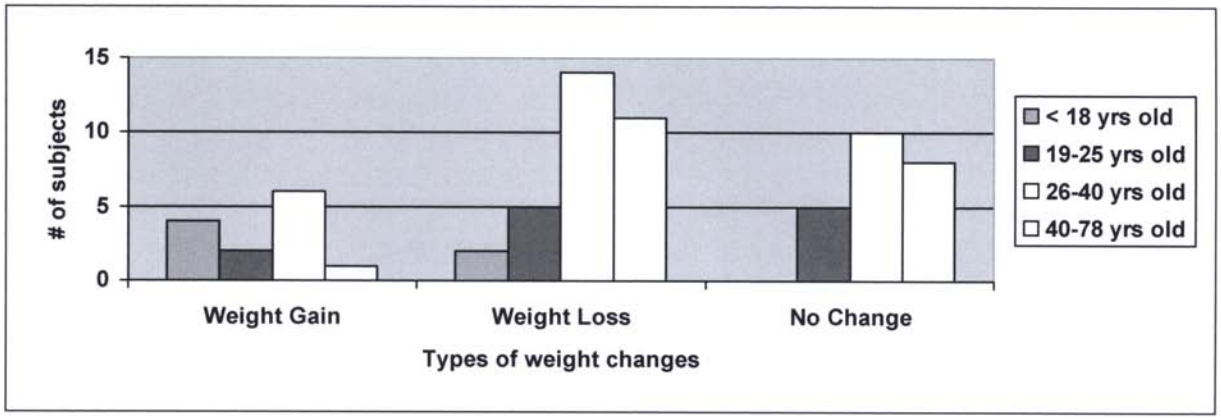

Figure 11. Weight changes shown by age group

Exercise. Another question on the survey which addressed lifestyle changes was "After being diagnosed with diabetes, did you begin to exercise on a regular basis?" Overall 63 out of 99 participants answered yes to this question.

Table 14 shows the number of type 1, type 2, and gestational diabetics who reported excising on a regular basis after receiving education about their diabetes condition. Sixty-six percent of type 1 diabetics, sixty-three percent of type 2 diabetics, and forty percent of gestational diabetics had begun to exercise.

Table 14. Number of respondents who have begun to exercise shown by types

	Yes	No
Type 1	40	20
Type 2	17	10
Gestational	4	6

Table 15 shows responses to this question by male and female respondents. Fifty-five percent of females and seventy-six percent of males have begun to exercise.

Table 15. Number of respondents who have begun to exercise shown by gender

	Yes	No
Female	34	27
Male	29	9

The number of subjects in each age group who reported starting exercise are shown in Table 16. Sixty percent of the 18 and younger age group have begun to exercise. Fifty-seven percent of the 19-25 years old age group had begun to exercise. Seventy percent of the 26-39 years old age group had begun to exercise. Sixty-one percent of the 40-78 years old age group had begun to exercise.

Table 16. Number of respondents who have begun to exercise shown by age group

	Yes	No
< 18 yrs old	9	6
19-25 yrs old	12	9
26-39 yrs old	26	11
40-78 yrs old	14	9

The survey respondents who reported beginning to exercise were also asked what types of exercise they performed. As shown in Table 17, 86% did aerobic exercise such as walking, running, elliptical, Stairmaster, cycling, strength training, 57% participated in strength training (machine weightlifting, elastic bands, free weights), 19% reported stretching activities (pilates, yoga, tai chi), 5% participated in sports (golf, baseball, basketball, softball, volleyball), and 12% reported other activities such as swimming, daily activities, boxing, and ballet.

Table 17. Types of exercise performed by respondents

	Aerobic	Strength	Stretching	Sports	Other
Overall	54	36	12	3	7

Table 18 displays the types of the exercise performed by type 1, type 2, and gestational diabetics. The most popular exercise that was selected by all groups is

aerobic. The second most frequent type was strength training, followed by playing sports, and stretching exercise.

Table 18 Types of exercise performed, shown by diabetic group

	Aerobics	Strength Training	Stretching	Sports
Type 1	32	25	8	18
Type 2	17	10	3	3
Gestational	4	1	0	0

Table 19 displays the kinds of exercise performed by the male and female participants. The most popular exercise performed by both female and male diabetics was aerobic exercise. The least frequent type of exercise performed by males is stretching. The least frequent type of exercise performed by females is sports.

Table 19. Types of exercise performed shown by gender

	Aerobics	Strength Training	Stretching	Sports
Female	29	17	9	8
Male	25	19	3	15

Table 20 displays what kinds of exercise are performed by the participants of various ages. The most popular exercise performed by all age groups is aerobic exercise.

The least frequent type of exercise performed by age group 40-78 years old is sports. The least frequent type of exercise performed by the other age groups is stretching.

Table 20. Types of exercise performed shown by age group

	Aerobics	Strength Training	Stretching	Sports
< 18 yrs old	5	4	3	6
19-25 yrs old	10	9	2	7
26-40 yrs old	23	15	4	8
40-78 yrs old	8	7	3	2

The participants were asked how many hours per week they typically exercised. Responses are shown in Figure 12.

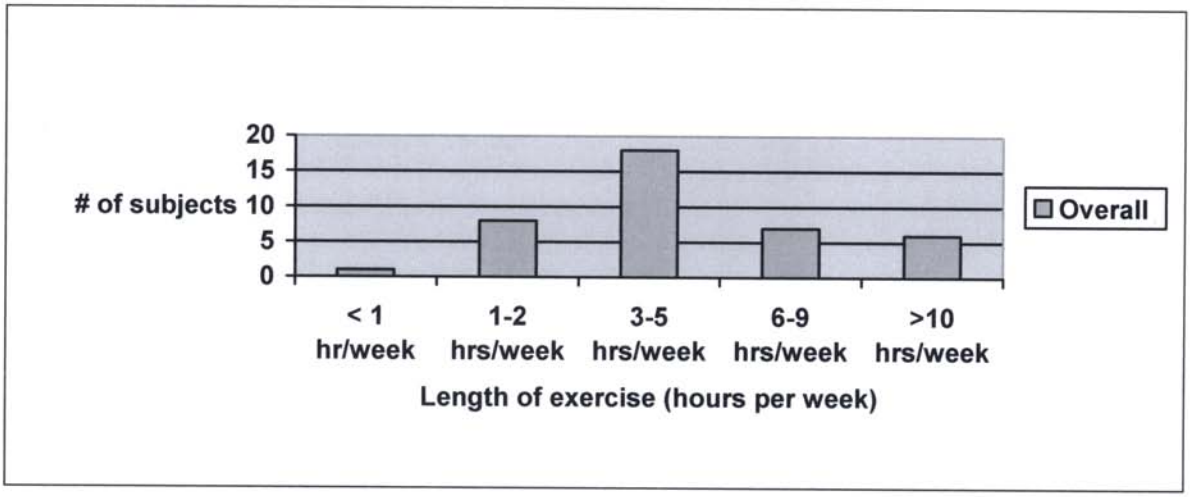

Figure 12. Number of hours of exercise per week

Figure 13 represents how long type 1, type 2, and gestational diabetics exercise in hours per week. The most frequent response for type 1 and type 2 diabetics was three to five hours per week. The most frequent for gestational diabetics was one to two hours per week.

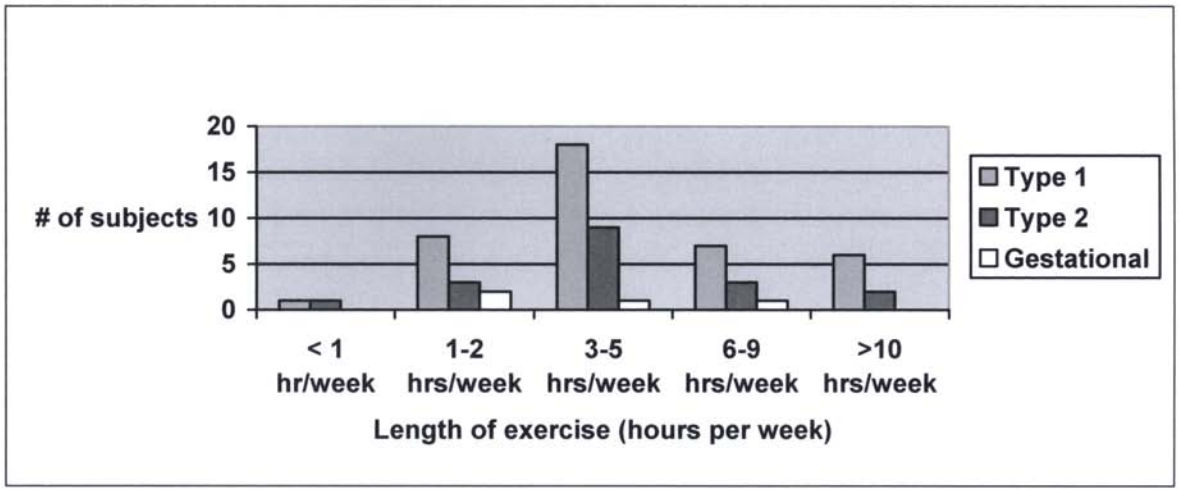

Figure 13. Number of hours of exercise per week, shown by diabetic group

Responses for the male and female subjects are shown in Figure 14. The most frequent length for both male and female is three to five hours per week.

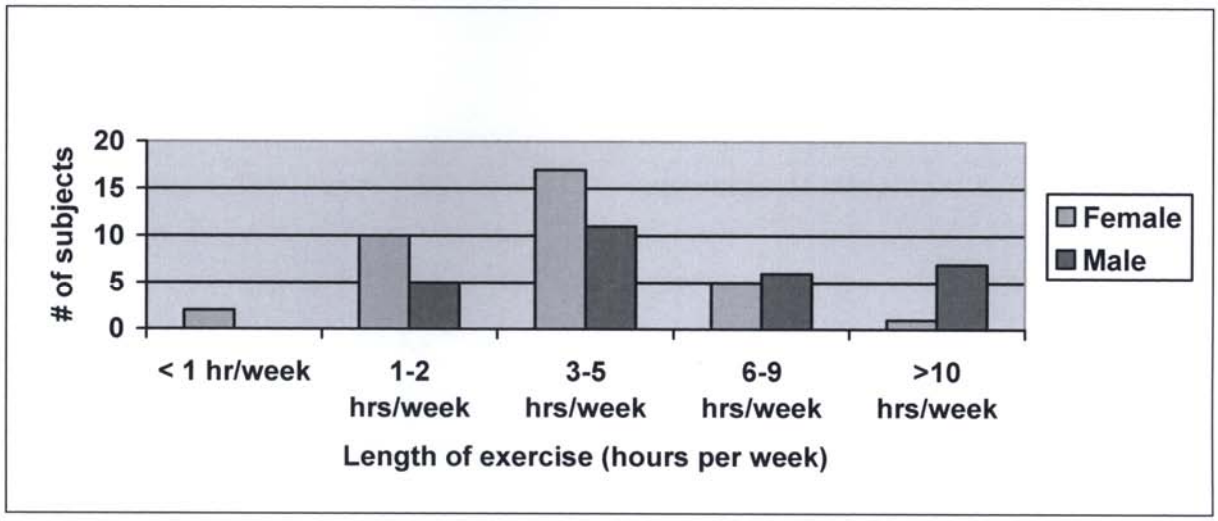

Figure 14. Number of hours of exercise per week for male and female subjects

Figure 15 displays the responses about quantity of exercise broken down by age group. The majority of the 18 years old and younger reported working out for one to two hours per week. The majority of the 19-25 year olds work out either three to five hours per week or six to nine hours per week. The majority of the 26-40 year olds and 40-78 year olds workout for six to nine hours per week.

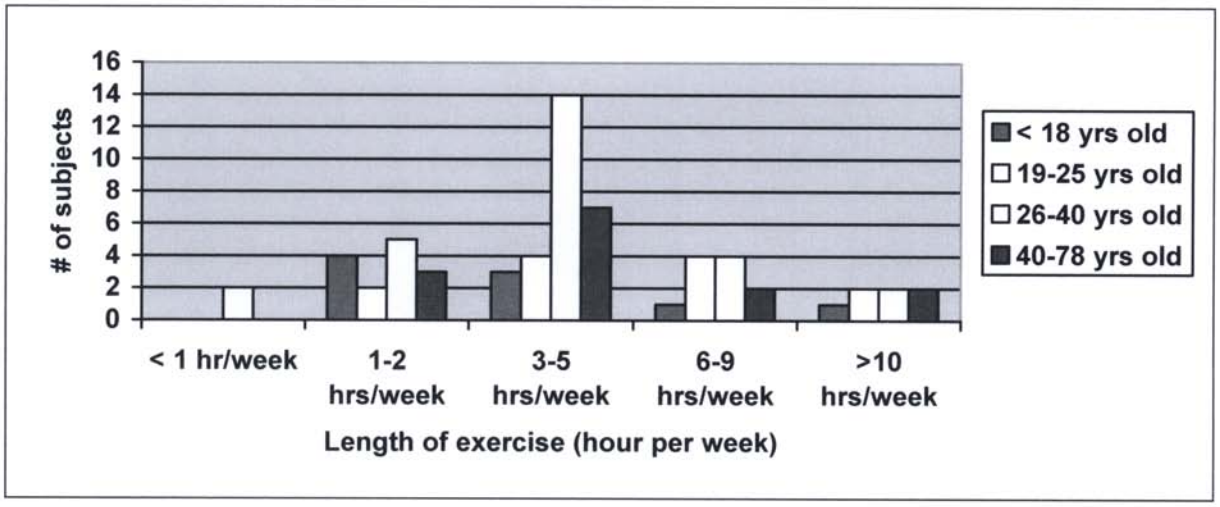

Figure 15. Number of hours of exercise per week shown by age group

Survey participants were also asked whether they checked blood glucose values before and after exercise. Thirty-nine participants (62% of exercisers) began to check their blood sugar levels before exercise. Thirty-four participants (54% of exercisers) began to check their blood sugar levels after exercise.

There were some differences between diabetic groups in adoption of blood glucose monitoring before and after exercise. Sixty-nine percent of Type 1 diabetics, forty-five percent of Type 2 diabetics, and fifty percent of gestational diabetics check their glucose pre-exercise.

Sixty-eight percent of Type 1 diabetics check their glucose post-exercise, but only twenty-nine percent of Type 2 diabetics and twenty-five percent of gestational diabetics check their glucose post-exercise.

There were also differences between genders in glucose monitoring before and after exercise. Only 50% of men reported checking glucose pre-exercise, while 71% of the women indicated that they did.

Post-exercise blood glucose checks were made by 48% of men and 59% of women. The youngest survey respondents were most likely to do pre-exercise blood glucose checks. Eighty-nine percent of subjects 18 years and younger checked their glucose pre-exercise. In the age group 19-25, 42% checked their glucose pre-exercise, while 67% of the age group 26-39 and 57% of age group 40-78 years old checked their glucose pre-exercise.

Post-exercise testing was reported by 67% of the group 18 years and younger, 42% of the 19-25 year olds, 67% of the 26-39 year olds, but only 31% of the 40-78 year olds.

There were several positive changes noticed by participants who began checking blood sugar levels before/after exercise: 23 participants (30%) noticed improved control in glucose levels, 18 participants (24%) became more informed of levels, five participants (7%) lost weight, 22 participants (29%) felt better physically and mentally, and seven participants (9%) noticed other effects such as: preventing crash lows, more preparation during exercise, and a drop or stable blood sugar during exercise but a rise there after.

In Table 21 these benefits are broken down by type of diabetes and in Table 22 they are shown for the various age groups.

Table 21. Benefits of pre- and post-exercise blood glucose checks, shown by diabetic type

	Glucose Control	Informed of Levels	Losing Weight	Feeling Better
Type 1	17	16	4	17
Type 2	23	1	1	3
Gestational	0	0	0	1

Table 22. Benefits of pre- and post-exercise blood glucose checks, shown by age group

	Glucose Control	Informed of Levels	Losing Weight	Feeling Better
< 18 yrs old	3	4	0	3
19-25 yrs old	4	4	1	4
26-39 yrs old	13	8	3	12
40-78 yrs old	3	1	1	2

Sleep. Survey respondents were also asked the following question: "After receiving education about your diabetic condition, are you aware of changes in your blood sugar levels while you are sleeping?" Overall 62 out of 99 participants that answered the question have become more aware of how blood sugar levels change while sleeping.

As witnessed Table 23, type 1 diabetics are the most likely to be aware of changes in blood glucose during sleep. Fifty-nine percent of females and sixty-eight percent of males reported being more aware of changes in sugar levels while sleeping. Response differences to this question among the various age groups are shown in Table 24. Forty-two percent of 18 year old and younger, sixty-seven percent of 19-25 year olds, seventy-four percent of 26-39 year olds, and forty-one percent of 40-78 years old became more aware of changes in sugar levels while sleeping.

Table 23. Awareness of blood glucose levels during sleep (diabetic type)

	Type 1 Diabetes	Type 2 Diabetes	Gestational Diabetes
Yes	40	14	6
No	19	14	4

Table 24. Awareness of blood glucose levels during sleep (Age groups)

	< 18 yrs old	19-25 yrs old	26-40 yrs old	40-78 yrs old
Yes	10	14	29	9
No	14	7	10	13

As a follow-up, respondents to previous question were asked "What changes have you noticed in your sleep patterns?" The most frequent reported change was food intake before bed (32 participants). Other changes included time they went to bed (14), drink intake before bed (16), length of sleeping (18), and no change (16). Nineteen participants indicated something other such as: go to bathroom a lot at night, dawn phenomenon, alcohol, interruptions from hypoglycemic reactions, and when the glucose levels are low participant will wake up sweating.

Positive Changes in Lifestyle. Survey respondents were asked the question: "After receiving education about your diabetic condition, do you feel more motivated to make positive changes in your everyday lifestyle?" Eighty-three of the one hundred respondents gave a positive response, indicating that patient education had some positive

influence on their lifestyles. The positive response to this question was similar with all types of diabetes. Eighty percent of type 1 diabetics, eighty-six percent of type 2 diabetics, and one-hundred percent of gestational diabetics felt motivated to make positive lifestyles changes. The response was also similar between genders with 84% percent of females and 79% of males feeling more motivated to make positive changes in their everyday lifestyle. There were some differences, however, in response among the age groups. Only 40% of 18 years old and younger felt more motivated to make positive changes in everyday lifestyle compared to 76% of 19-25 year olds, 95% of 26-39 year olds, and 86% of 40-78 year old respondents.

The types of lifestyle changes reported by study participants are shown in Figure 16. Seven participants made other changes such as: changed to new insulin, more positive attitude, relationships, faith, well-being, and more aware of family history of diabetes.

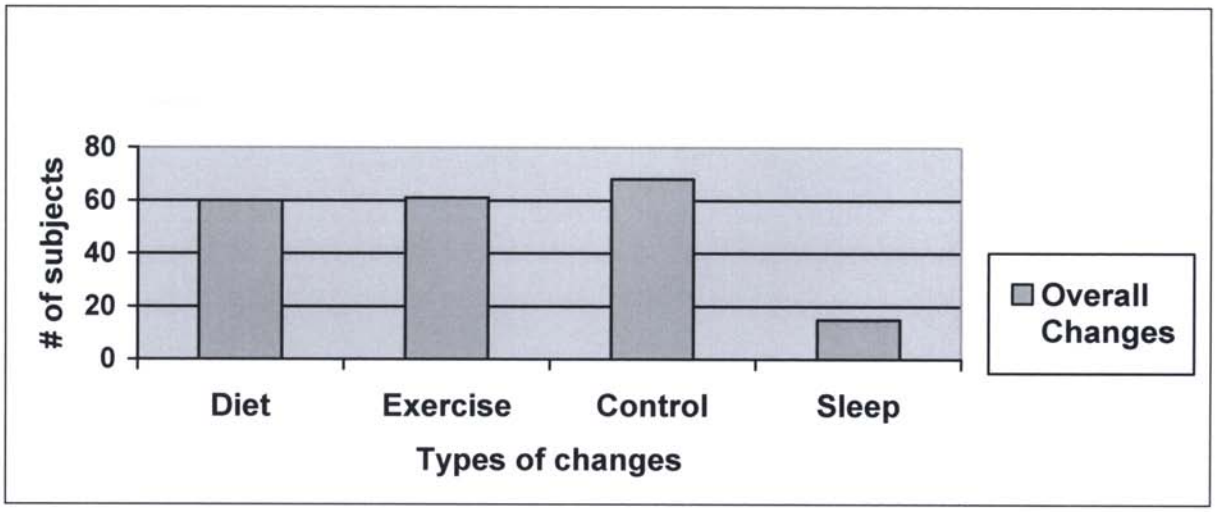

Figure 16. Reported changes in lifestyle after diabetes diagnosis

Figure 17 shows the positive lifestyle changes made by respondents with different types of diabetes. Type 1 diabetics felt the most motivated to control blood glucose. Type

2 and gestational diabetics felt the most motivated to change their diets.

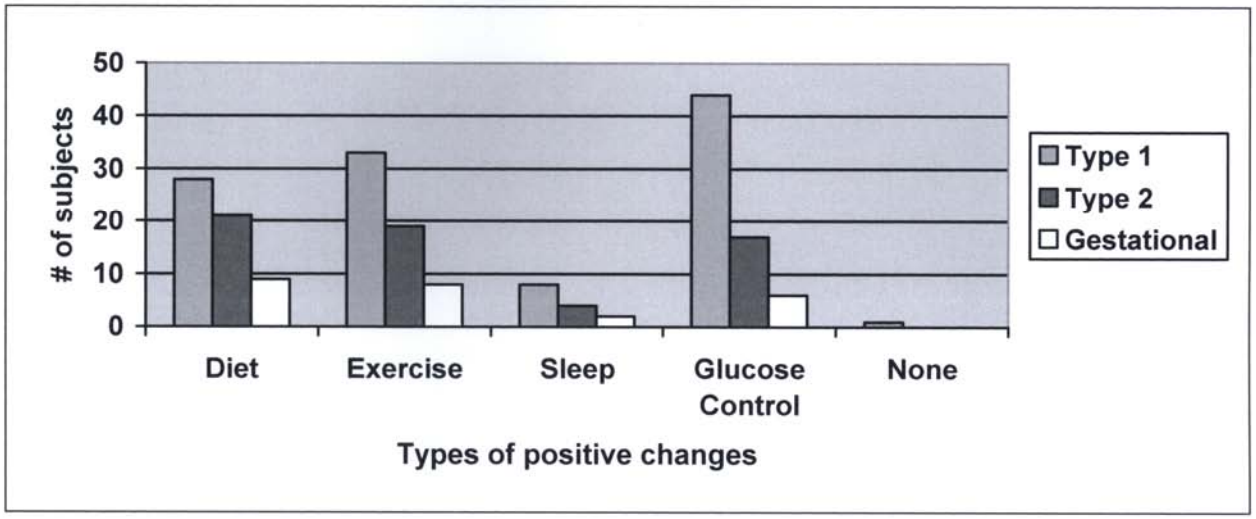

Figure 17. Reported changes in lifestyle after diabetes diagnosis (diabetes type)

Figure 18 displays positive changes the diabetic participants of different ages felt more motivated to make. The biggest change for age groups 18 years old and younger, 19-25 years old and 40 to 78 years old was control over blood glucose levels. The biggest change for 26-39 year olds was exercise changes. The least frequent positive change for all ages groups was sleep changes.

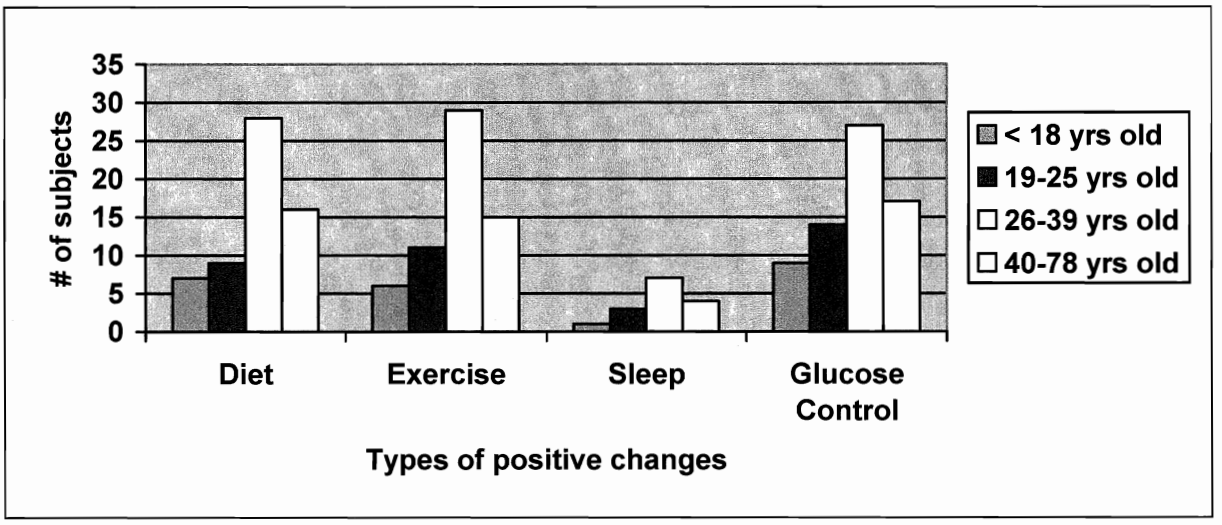

Figure 18. Reported changes in lifestyle after diabetes diagnosis (age groups)

Control

The final question asked on the survey was: "After receiving education about your diabetic condition, do you feel you have more control of blood sugar levels?" Overall 88 out of 100 participants responded that they did have more control over blood sugar levels after receiving education. This result was consistent among the participants with different types of diabetes. Eighty-five percent of type 1 diabetics, eighty-nine percent of type 2 diabetics, and one-hundred percent of gestational diabetics felt they had more control of blood sugar levels after receiving education. There were some gender differences, as 92% of females but only 74% of males felt they have more control of blood sugar levels after receiving education. There was also one noticeable age group difference where 76% of 19-25 year olds felt they have more control of blood sugar levels compared to 93% of 18 year olds and younger, 92% of 26-39 year olds, and 95% of 40-78 year olds.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to compare the effectiveness of various types of patient education in motivating diabetic patients to make lifestyle changes and helping patients identify causes of suboptimal control of blood glucose. Patient educational tools to be compared included verbal information from a physician, consultations with a dietician, sessions with a diabetes educator, written materials such as pamphlets or brochures, Internet sources of information, use of the Continuous Glucose Monitoring System, and use of finger stick glucose monitoring. It was hypothesized that the Continuous Glucose Monitoring System would be the most effective educational tool for the survey respondents.

Conclusions

1. Based on the survey results, education was extremely important and beneficial for motivating and helping diabetic patients make lifestyle changes and identify causes of suboptimal control of blood glucose.
2. The education that had the most impact overall was a consultation with a diabetes educator. This did not support the initial hypothesis that the CGMS would be most effective.
3. The majority of subjects made positive dietary changes. The most likely change was having less sugar and the least likely was consuming less alcohol.
4. Type 2, gestational diabetics, and females were more likely to changes their diets.
5. The older the participant the more likely they were to change their diets.

6. The older the participants were the more likely they were to have weight loss.
7. The younger the participant the more likely they were to have weight gain, although this could be attributed to growth.
8. After receiving education the majority of the participants began exercising on a regular basis.
9. Males were more likely to begin regular exercise after receiving education than females.
10. The most common type of exercise performed was aerobic exercise and the least common exercise performed was sports.
11. Females and males exercised the same time length on a weekly basis but females were more likely to check their blood glucose levels before and after exercise than males.
12. The older the participant was the more time they spent exercising on a weekly basis. But the younger participants were more likely inclined to check their glucose levels before and after exercise compared to older participants.
13. The most common change for all types, genders and ages for checking their blood glucose levels before and after exercise was improving the control of glucose levels.
14. After receiving education the majority became aware of changes in glucose levels during sleep.
15. After receiving education the majority of participants felt they had more control over blood sugar levels.
16. Females were more likely to have control over blood sugar levels than males.

17. The age groups 18 years and younger, 26-39, and 40-78 year olds had more control over blood sugar levels after education than ages 19-25 year olds.

Implications Found

The National Standards for Diabetes Self-Management Education were published in January 2008 and provide standards covering structure, process, and outcomes of diabetes education. The standards stress the importance of patient education with a multi-disciplinary team. The results from the present survey showed that 35 participants believed a consultation with a diabetic educator has the most overall impact. Allowing each patient a consultation with a diabetic educator would be a vital part of educating the diabetes population.

The standards do not distinguish for special populations such as type of diabetes, gender, and age. The results of this survey found there are different responses from different segments of the population. For example, type 1 and gestational diabetics indicated that a consultation with a diabetic educator had the most impact while type 2 diabetics chose consultation with a dietician to have the most educational impact There were also age group differences in response among age groups. Respondents 18 years old and younger, 19-25 years old, and 26-39 years old felt that a consultation with a diabetes educator had the most impact, while subjects age 40-78 years old were impacted by verbal information from a physician, a consultation with a diabetes educator, and written materials such as pamphlet or brochures. Standard 7 emphasizes the importance of having an individual assessment and education plan for each patient, while Standard 8 addresses the importance of a personalized follow-up plan for ongoing self-management

support. (Funnell,et al. 2008). Having specific plans for special populations may benefit diabetics.

Recommendations

Future studies should ask the question of racial background of the participants who filled out the survey. Several articles reviewed in chapter two addressed cultural differences and barriers to patient education. Another demographic question that should be asked is: How long since you were diagnosed with diabetes? Subjects should also be asked a question about multidisciplinary team benefits. A multi-disciplinary team was addressed in the The National Standards for Diabetes Self-Management Education 2008 edition. Another way to evaluate the different types of education and the impact would be to use a Likert scale.

It is recommended that each person diagnosed with diabetes should meet with a diabetes educator considering the amount of impact they have had on the participants in the survey. Receiving education about their diabetic condition is essential when coping with this disease on a daily basis, especially to improve the quality of life of individuals with diabetes.

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APPENDIX A

COVER LETTER

Dear Diabetic Participants,

My name is Katey Korhonen. I am a graduate student at Eastern Illinois University in the Kinesiology and Sports Studies department with a focus in Cardiac Rehabilitation. I am conducting my thesis on people with diabetes and effective treatments that will help with stabilizing their blood sugar levels.

The purpose of my study is to compare the effectiveness of various types of patient education in motivating people with diabetes to make lifestyle changes and helping patients identify causes of suboptimal control of blood glucose. Patient educational tools to be compared include verbal information from a physician, Continuous Glucose Monitoring System, consultation with a dietician, consultation sessions with a diabetes educator, written materials such as pamphlets or brochures, and Internet sources of information.

I am searching for people who have Type 1, Type 2, or gestational diabetes. If you agree to participate in the study, you will be completing an anonymous on-line survey.

I would greatly appreciate your help in answering this short survey. It should only take five minutes to complete. If you would like to continue the following is the link to the survey.

http://www.my3q.com/go.php?url=kateykorhonen/90108

Once you have completed the survey it will be in an anonymous mailbox allowing the results to be viewed.

Please take the time to complete my survey. This can be a great advantage to you and all other diabetics as well. The results from this survey can help us to understand more about diabetes and further educate others on this disease. Thank you very much for completing this survey. You have now made a positive impact towards finding the best education tool for diabetics.

If you wish further information about this project or you would like to learn the results, please feel free to email me.

Sincerely,

Katey Korhonen
Kateykor@yahoo.com

Supervisor of Research
Dr. Phyllis Croisant
Professor in Kinesiology and Sports Studies
Ptcroisant@eiu.edu

APPENDIX B

SURVEY

1) What is your gender?
   Male
   Female

2) What is your age?
   21-40
   41-60
   61-80
   81-100

3) What type of diabetes were you diagnosed with?
   Type 1
   Type 2
   Gestational
   I don't know

4) At follow up visits has your doctor told you that you need to have better control over your blood sugar levels?
   Yes
   No

5) How many times a day do you check your blood sugar level?
   0
   1
   2
   3
   4
   5 or more

6) What type of education have you received since being diagnosed with diabetes? (Check all that apply)
   Verbal information from a physician
   Consultation with a dietician
   Consultation with a diabetes educator
   Continuous Glucose Monitoring System
   Written materials such as pamphlets or brochures
   Internet sources of information
   Other, please explain:
   None of the above

7) If receiving more than one type of education, which type of education had the most impact?

Verbal information from a physician
Consultation with a dietician
Consultation with a diabetes educator
Continuous Glucose Monitoring System
Written materials such as pamphlets or brochures
Internet sources of information
Other, please explain:
None of the above

8) After receiving education about your diabetic condition, have you changed your diet?
Yes
No If No, continue to question #11

9) What has changed about your diet? (Check all that apply)
Less Starch
Less Sugar
Less Fat
Less Alcohol
Other, please explain:

10) Has your weight changed since you were diagnosed with diabetes?
No change
Weight Gain
Weight Loss

11) After receiving education about your diabetic condition have you begun to exercise on a regular basis?
Yes
No If No, continue to question #17

12) What kind of exercises do you perform? (Check all that apply)
Aerobic (such as Walking, Running, Elliptical, Stairmaster, Cycling)
Strength Training (such as machine weightlifting, elastic bands, free weights)
Stretching (such as Pilates, Yoga, Tai Chi)
Sports (such as Golf, Baseball, Basketball, Softball, Volleyball)
None of the above
Other

13) How long do you exercise?
Less than 1 hour/week
1-2 hours/week
3-5 hours/week
6-9 hours/week
10 or more hours/week

14) After receiving education about your diabetic condition have you begun to check your blood sugar before exercising?

Yes
No

15) After receiving education about your diabetic condition do you check your blood sugar after exercising?

Yes
No If No, continue to question #17

16) What changes have you noticed after checking your blood sugar levels before/after exercise? (Check all that apply)

Improved control in glucose level
Becoming more informed of levels
Losing weight
Feel better physically and mentally
None of the above
Other, please explain

17) After receiving education about your diabetic condition, are you aware of changes in your blood sugar levels while you are sleeping?

Yes
No If No, continue to question # 19

18) What changes have you noticed in your sleep patterns? (Check all that apply)

Time you go to bed
Food intake before bed
Drink intake before bed
Length in sleeping
None of the above
Other, please explain:

19) After receiving education about your diabetic condition, do you feel more motivated to make positive changes in your everyday lifestyle?

Yes
No If No, continue to question #21

20) What positive changes do you feel more motivated to make? (Check all that apply)

Diet changes
Exercise changes
Sleep changes
Control of blood glucose
None of the above
Other, please explain

21) After receiving education about your diabetic condition, do you feel you have more control of blood sugar levels?

Yes
No